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Vol. 13, No. 5
March 15, 1988

Energy Research Abstracts

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ENERGY RESEARCH ABSTRACTS

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88-00127

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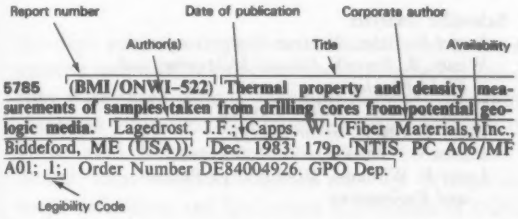
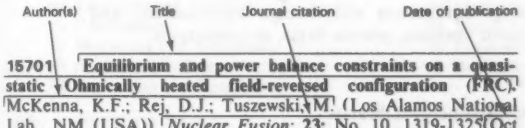


5785 (BMI/ONWI-522) **Thermal property and density measurements of samples taken from drilling cores from potential geologic media.** Lagedrost, J.F.; Capps, W. (Fiber Materials, Inc., Biddeford, ME (USA)). Dec. 1983. 179p. NTIS, PC A06/MF A01; I; Order Number DE84004926. GPO Dep.

Density, steady-state conductivity, enthalpy, specific heat, heat capacity, thermal diffusivity and linear thermal expansion were measured on 59 materials from core drill samples of several geologic media, including rock salt, basalt, and other associated rocks from 7 potential sites for nuclear waste isolation. The measurements were conducted from or near to room temperature up to 500°C, or to lower temperatures if limited by specimen cracking or fracturing. Ample documentation establishes the reliability of the property measurement methods and the accuracy of the results.



15701 **Equilibrium and power balance constraints on a quasi-static Ohmically heated field-reversed configuration (FRC).** McKenna, K.F.; Rej, D.J.; Tuszewski, M. (Los Alamos National Lab., NM (USA)). *Nuclear Fusion;* **23:** No. 10, 1319-1325 (Oct 1983).

Abstract

Zero-dimensional power balance calculations are performed for a quasi-static, purely Ohmically heated field-reversed configuration. Without compression, the constraint imposed by radial pressure balance limits the power input. Estimates of the energy loss from impurity line radiation as well as from classical and anomalous transport are given. Effects of cold puff gas injection are also investigated.

INDEXES TO *ENERGY RESEARCH ABSTRACTS*

Five indexes are provided for approaching the contents of each issue of *Energy Research Abstracts (ERA).* Each index is preceded by an introduction that details the organization of the index and the principles by which it was compiled. The reader is referred to these introductions for information not found in the index examples that follow.

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5785 **(BMI/ONWI-522) Thermal property and density measurements of samples taken from drilling cores from potential geologic media.** Lagedrost, J.F.; Capps, W. **(Fiber Materials, Inc., Biddeford, ME (USA)).** Dec. 1983. 179p. NTIS Order Number DE84004926. GPO Dep.

is indexed as:

Fiber Materials, Inc., Biddeford, ME (USA)

• Personal Author Index

Each author's name is indexed in the form appearing on the document abstracted, with the exception that given names are reduced to initials:

Capps, W., *See* Lagedrost, J. F.
Lagedrost, J.F., Thermal property and density measurements of samples taken from drilling cores from potential geologic media, 9:5785 (R;US)
McKenna, K.F., Equilibrium and power balance constraints on a quasi-static Ohmically heated field-reversed configuration (FRC), 9:15701 (J;US)
Rej, D.J., *See* McKenna, K.F.
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• Subject Index

The subject index consisting of entries naming specific materials, objects, and processes is arranged alphabetically. Document titles, informative phrases, or both specific to these entries are arranged alphabetically under the entries.

SALT DEPOSITS
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Thermal property and density measurements of samples taken from drilling cores from potential geologic media, 9:5785 (R;US)
REVERSED-FIELD PINCH
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Equilibrium and power balance constraints on a quasi-static Ohmically heated field-reversed configuration (FRC), 9:15701 (J;AT)

• Contract Number Index

DOE technical report literature is indexed using contract numbers. This index contains the contract number with corresponding abstract and report numbers.

AC06-76RL01830	**Fiber Materials, Inc., Biddeford, ME (USA)**	
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• Report Number Index

Technical report literature is also indexed using report numbers. This index includes information on where individual reports may be obtained. Patents and conference papers are indexed here as a matter of convenience. When a report is supplied under an Order Number, that number is included in the availability statement. An Order number–report number correlation is included for convenience.

BMI/ONWI-522	9:5785	NTIS, PC A09/MF A01. Order Number DE84004926, Distribution Category MN-70

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ENERGY RESEARCH ABSTRACTS

01 COAL AND COAL PRODUCTS

REFER ALSO TO CITATION(S) 9024, 9025

8374 **(DOE/PC/91404—T5) Research needs and data acquisition to apply US technology to foreign coals: Quarterly report, August-October 1987.** (Viking Systems International, Pittsburgh, PA (USA)). 1987. Contract AC22-86PC91404. 21p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88002992/JAW.

Viking Systems International (VSI) has been providing technical assistance to the Pittsburgh Energy Technology Center (PETC) in the development of an international database on coal resources, coal characteristics and coal conversion technologies in the countries of Asia and the Pacific Basin. The objective of this technical support service is to improve the understanding of major coal resources in the countries of Asia and the Pacific Basin so that advanced US coal preparation, conversion, and utilization technologies can be applied to these coals. In Phase I of the contract, databases were developed on coal characteristics, coal resources and electric utilities. Profiles of coal resources, production and consumption were developed for the countries of the Pacific Basin and Asia. 5 figs., 3 tabs.

0103 Preparation

REFER ALSO TO CITATION(S) 8388, 8390, 8403, 8422

8375 **(CONF-870802—31) The preparation and distribution of Argonne Premium Coal Samples.** Vorres, K.S. (Argonne National Lab., IL (USA)). 1987. Contract W-31109-ENG-38. 6p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE88002830/JAW.

From 194. American Chemical Society national meeting; New Orleans, LA, USA (30 Aug 1987).

The eight Argonne Premium Coal Samples were each collected in about 1-1/2 ton quantities, placed in steel drums, purged with argon and taken to ANL for processing. After transfer to a nitrogen filled enclosure, they were crushed, pulverized, mixed and packaged in sealed amber borosilicate ampoules containing 10 grams of -20 mesh or 5 grams of -100 mesh sample. Five gallon carboys hold about 80% of the batch in reserve for filling more ampoules after the original about 5000 of -20 mesh or 10,000 of -100 mesh samples are depleted. More than 70 laboratories are participating in the analysis. Over 90 shipments have been made to more than 45 different organizations for a range of programs which will be the subject of later papers in the symposium.

8376 **(CONF-870999—2) Investigation of open-gradient magnetic separation for Illinois coal.** Doctor, R.D.; Livengood, C.D.; Genens, L.E.; Swietlik, C.E.; Foote, K. (Argonne National Lab., IL (USA)). 1987. Contract W-31109-ENG-38. 13p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88002858/JAW.

From 2. international processing and utilization of high-sulfur coal conference; Carbondale, IL, USA (28 Sep 1987).

Open-gradient magnetic separation (OGMS) using superconducting quadrupole magnets is a novel coal-beneficiation technology offering high pyritic-sulfur removal from pulverized dry coal. The system operates in a continuous mode, uses no chemicals, and has an estimated power demand 75% lower than techniques using conventional electromagnets, while achieving magnetic separation forces up to 267% higher. Specifically applicable to finely ground coal (120 to 325 mesh), OGMS could encourage the commercialization of other developing coal technologies, such as coal-water slurries, fludized-bed combustion, and coal synfuels. Both the experimental program conducted by Argonne National Laboratory and the results of modeling in support of the experimental program are described. 11 refs., 9 figs.

8377 **(DOE/PC/80523—T8) Surface and electrochemical studies in coal cleaning: Technical progress report, July 1, 1987-September 30, 1987.** Chander, S.; Aplan, F.F. (Pennsylvania State Univ., University Park (USA)). 1987. Contract FG22-85PC80523. 8p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88002115/JAW.

The main objectives of this project are: (1) characterization of the coal, ash forming minerals and sulfur bearing minerals in coal from different sources; (2) development of a novel electrochemical methods to characterize coal pyrites; and (3) separate pyrite from coal. The characterization studies, which include surface, mineralogical and electrochemical characterization are aimed at obtaining the basic background information about the properties of coal and its constituents. This information is expected to be of value in the design and analysis of various precombustion coal cleaning processes and conversion technologies.

8378 **(EPRI-CS—5423) Recovering clean coal from anthracite culm: Coal Quality Development Center Campaign Report No. 8: Interim report.** Torak, E.R.; Bhowmick, A.K.; Cavalet, J.R.; Parsons, T.H. (Kaiser (Raymond) Engineers, Inc., Homer City, PA (USA). Homer City Office; Science Applications International Corp., Homer City, PA (USA). Homer City Office; Pennsylvania Electric Co., Johnstown (USA); New York State Electric and Gas Corp., Binghamton (USA)). Nov 1987. 172p. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88920098/JAW.

Recovering Clean Coal from Anthracite Culm contains the results of an investigation into the cleanability of coarse anthracite (termed "culm") excavated from a refuse bank in Schuylkill County, Pennsylvania. This characterization consisted of five interrelated efforts: Unprocessed Coarse Culm Characterization, Laboratory Froth Flotation Testing, Impurities Liberation Investigation, Culm-Cleaning Evaluation, and Combustion Characteristics Comparison. Significant cleanability characterization findings were that: although the unprocessed culm is sticky, plastic, and extremely difficult to handle and store, cleaning makes this fuel easy to transport, store, and handle using conventional power plant equipment. In the characterization, cleaning reduced culm dry ash content from 59% to 11% while recovering 50% of the original culm energy content. Part of the cleanability characterizations involved testing of a new pre-cleaning device; a SuperScalper. In these tests it was demonstrated that the SuperScalper can economically increase the capacity of conventional cleaning units in recovering clean coal from anthracite culm. The SuperScalper can save 40% of the capital cost of a new cleaning plant and 30% of its operating cost when used to pre-clean the feed to concentrating tables. The SuperScalper also shows promise as a rough cleaning device to be used in reclaiming bituminous coal refuse for use in fluidized bed combustors, although further studies are needed to evaluate the economics of this application. 8 refs., 20 figs., 31 tabs.

8379 **(EUR—10903-EN) Investigations to improve the handlability of wet fine coal.** (Commission of the European Communities, Luxembourg). 1986. 50p. European Community Information Service, 2100 M St., NW, Suite 707, Washington, DC 20037.

Describes the work aimed at providing solutions to the problem of coal fines handlability. Initial work concentrated on laboratory studies. Coal fines agglomeration was one favourable option

considered and comprehensive investigations were conducted of the known methods of agglomeration available. Ring die pelletization was considered the most suitable. The conclusion of laboratory studies indicated coal fines pelletization as the best option to pursue for improvement in handlability. A 3.5 t/h pelletization pilot plant was constructed at a colliery site. This plant has provided valuable data relating to process parameters for pelleting various types of coal, the modifications necessary to standard proprietary pellet mill equipment applied to coal, operational expertise and the estimate of likely costs for large scale production plants. Coal pellets have been produced from both bituminous and anthracite coal fines in dimensions ranging from 12 mm diameter to 25 mm diameter. Various markets have been assessed for the use of coal pellets such as power generation, industrial boiler plants and domestic use. For the purpose of handlability improvements, pelletization parameters are firmly established. The conclusions drawn from this project work indicate further important investigation work. Pilot plant operation at 3.5 t/h is not large enough to determine accurate future plant costs and does not allow an accurate assessment of any difficulties associated with continuous and long term operation. Furthermore, the plant does not provide sufficient pellets for large scale handlability trials, for example, colliery site to power generation plant. It is proposed, therefore, that a 15-20 t/h plant is constructed to meet the above requirements.

8380 **(NP—8750526) Separation of hard-to-prepare small coal fines below 2 mm in size on jigs by optimizing the jig-stroke diagram and the discharge control. Final report.** Schneider, D. (Technische Hochschule Aachen (Germany, F.R.). Lehrstuhl und Inst. fuer Aufbereitung, Kokerei und Brikettierung; Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). 1986. 104p. (In German). NTIS (US Sales Only), PC A06/MF A01. Order Number DE88750526/JAW.

Based on former findings about the separation of hard-to-prepare coal below 2 mm in size investigations should improve the selectivity of jigs; good cleaning results are obtained with unstepped and stepped jig stroke diagrams. Compared with unstepped jigging diagrams the jig stroke diagram with a four-step pulsation stroke was advantageous; all tests proved that most of the raw coal particles below 0,1 mm in size were insufficiently separated and got into the coal product; the discharge device was improved considerably by developing and installing a rotor ejector instead of a discharge gate; near the end of the project the test jig got a computer-controlled hydraulic plunger pulsation instead of the air pulsation. Compared with the air pulsated operation the cleaning results were only slightly better. With 29 refs., 19 tabs., 42 figs..

8381 **(NP—8750528) Development of briquettes for industrial firing plants. Final report.** Lehmann, J.; Kleisa, K.; Makrutzki, D.; Verfuss, F. (Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). Aug 1986. 85p. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88750528/JAW.

To develop hard coal briquettes for use in industrial firing plants, 20 briquette types of varying constitution were subjected to 39 burning tests in two grate firing systems of 4.4 viz. 4.1 MW rated capacity. As to the composition of briquettes, relevant feed coals, binders and lime additives ensuring an environmentally acceptable combustion were varied. The experiments run on a 10 tons scale showed that all of the briquette variations ignite uninhibited both in full load as well in reduced load operations and burn up better than the usual cobbles (burn-up levels above 98%). Lime additions resulted in desulphurization effects beyond 50% referred to the sulphur content in the combustible, thanks to SO/sub 2/ bonding to the ashes. Thereby the addition of molasse/lime turned out to be the most favourable among the binder/lime combinations examined. Furthermore when firing lime-containing briquettes reductions of NO/sub x/-emissions up to 50% were observed in comparison with briquettes without lime. Long-term storage tests run during the 1985/86 winter season on industrial coal/molasse/lime-containing briquettes proved adequate weathering resistance. Manufacturing of the briquettes is explained on a basic flow sheet. Calculations of the manufacturing costs of briquettes for industrial use show that they are competitive, indeed, against cobbles. With 11 tabs., 8 figs..

0104 Processing

REFER ALSO TO CITATION(S) 8378, 8411, 8417, 8421, 8424, 8432, 8443, 8957

8382 **(CONF-870659—6) Materials development for JPL oxygen plant.** Easler, T.E.; Poeppel, R.B. (Argonne National Lab., IL (USA)). Jun 1987. Contract W-31109-ENG-38. 11p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88003067/JAW.

From 7. annual gasification systems conference; Morgantown, WV, USA (16 Jun 1987).

The purpose of this research program is to establish the durability of thin electrolyte layers so that minimum component thicknesses may be used in a solid oxide oxygen pump, as the means of reducing internal power losses, while still maintaining the required mechanical integrity of the structure. The internal power losses are directly proportional to the product of the thickness and resistivity of the individual component material and inversely proportional to the active area. The reduction of these losses is desirable in order to enhance the solid oxide oxygen pump economics relative to conventional pumping techniques. Previous and current work in the scientific and industrial communities has proven the feasibility of fabricating thin-section ceramic components by techniques such as tape casting. Proof-of-concept work has also been carried out illustrating that thin ceramic sections can be successfully bonded together as anode/electrolyte/cathode units for fuel cells. Although this technology has been developing rapidly, there is a lack of information on the ability of these structures to survive the stress and/or strains imposed by the assembly configuration and operating conditions. Several potential failure modes have been identified. These are (1) thermal gradients induced by rapid cooling, (2) thermal gradients induced by nonuniform power dissipation, e.g., high-current hot spots, (3) interfacial stresses resulting from thermal expansion mismatch, (4) tensile and bending stresses introduced by clamping, (5) biaxial bending caused by unbalanced gas pressures across a thin section, (6) local stresses induced by corrosion or chemical reaction between components. The purpose of this program is to assess the importance of each of these failure modes through phenomenological tests, each of which approximates as nearly as practical the conditions leading to one specific failure type. 5 figs., 2 tabs.

8383 **(CONF-871059—1) Materials performance in coal gasification pilot plants.** Judkins, R.R.; Bradley, R.A. (Oak Ridge National Lab., TN (USA)). 15 Oct 1987. Contract AC05-84OR21400. 15p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88001417/JAW.

From Materials for coal gasification; Cincinnati, OH, USA (10 Oct 1987).

This paper presents the results of several materials testing projects which were conducted in operating coal gasification pilot plants in the United States. These projects were designed to test potential materials of construction for commercial plants under actual operating conditions. Pilot plants included in the overall test program included the Hygas, Conoco Coal, Synthane, Bi-Gas, Peatgas (Hygas operating with peat), Battelle, U-Gas, Westinghouse (now KRW), General Electric (Gegas), and Mountain Fuel Resources plants. Test results for a large variety of alloys are discussed and conclusions regarding applicability of these materials in coal gasification environments are presented. 14 refs., 2 tabs.

8384 **(CONF-871059—2) Alloy and coating development for coal gasification applications.** Natesan, K. (Argonne National Lab., IL (USA)). Sep 1987. Contract W-31109-ENG-38. 29p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88002962/JAW.

From Materials for coal gasification; Cincinnati, OH, USA (10 Oct 1987).

Over the years, three major avenues have been followed to improve the sulfur resistance of metallic materials. The first approach involves modification of bulk alloy composition such as increases in chromium and/or aluminum content; additions of refractory metals such as Zr, Nb, and Ti; and additions of microalloy constituents including rare earth elements. The second approach in-

volves modification of the surface region of engineering alloys via procedures such as ion implantation, sputtering of selected elements accompanied by ion beam mixing, etc. This approach can create a nonequilibrium alloy chemistry and microstructures that can impede the transport of reactants from the gas phase and cations from the alloy substrate. The third method involves coating of alloy surfaces with corrosion-resistant materials via techniques such as pack cementation, low-pressure plasma spray, and electrospark deposition. This approach generally results in chemical/metallurgical bonding between the deposit and the substrate alloy. The present paper discusses several of these approaches and provides corrosion rate and scale morphological information obtained at Argonne National Laboratory. 21 refs., 16 figs., 3 tabs.

8385 **(CONF-871059—4) A review of failure analysis experience on coal-gasification pilot plant components.** Diercks, D.R. (Argonne National Lab., IL (USA)). Sep 1987. Contract W-31109-ENG-38. 35p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88003090/JAW.

From Materials for coal gasification; Cincinnati, OH, USA (10 Oct 1987).

More than 30 coal-gasification process demonstration units (PDUs) and pilot plants have been constructed and operated during the past 15 years or so. The principal purpose of these plants, most of which are now either mothballed or dismantled, was to develop, evaluate, and optimize candidate surface coal-gasification processes. However, an important secondary benefit derived from the operation of these plants has been the experience and knowledge gained on materials performance and component reliability. As a result of this experience and knowledge, substantial progress has been made in improving component reliability through better materials selection, improved component design, and modification of plant operating conditions. The present paper reviews component failure-analysis experience for a number of these plants with respect to commonly observed failure causes.

8386 **(CONF-8111243—1) Converting syncrudes to transportation fuels: Appendix 1.** Sullivan, R.F.; O'Rear, D.J.; Frumkin, H.A. (Chevron Research Co., Richmond, CA (USA)). 1981. Contract AC22-76ET10532. 31p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88003129/JAW.

From Fuels and lubricants meeting; Houston, TX, USA (5 Nov 1981).

Syncrudes derived from oil shale and those produced in direct coal liquefaction processes can be converted to transportation fuels using modern commercial hydroprocessing technology. Upgrading routes typically consist of hydrogen addition and removal of heteroatom and inorganic impurities. This paper reviews refining routes and discusses the properties of finished transportation fuel products (gasoline, jet fuel, diesel) produced from syncrudes. Fuels produced from bituminous coal, subbituminous coal, and lignite are contrasted with those produced from oil shale and petroleum. Transportation fuels from shale oil resemble those from waxy petroleum crudes. Upgraded products from liquids made in H-Coal, EDS, and SRC-II direct coal liquefaction processes are low in paraffin content and consist mainly of cyclic hydrocarbons. As a result, the latter have some unusual and desirable properties for transportation fuels. 14 refs., 8 figs., 8 tabs.

8387 **(CONF-8610362—1) Refining comparisons: CTSL [Catalytic Two-Stage Liquefaction], ITSL [Integrated Two-Stage Liquefaction], and H-coal syncrudes.** Sullivan, R.F. (Chevron Research Co., Richmond, CA (USA)). 1986. Contract AC22-76ET10532. 16p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88003131/JAW.

From Direct liquefaction contractors' review meeting; Monroeville, PA, USA (20 Oct 1986).

Syncrudes produced from Wyodak coal in HRI's Catalytic Two-Stage Liquefaction (CTSL) process were upgraded in pilot plant tests by hydrotreating with Chevron's commercial ICR 106 catalyst. Two CTSL syncrudes were studied: the first had an end point (EP) of about 625°F; the second, an EP of about 850°F. In this paper, results are compared to those obtained with syncrudes from a single-stage liquefaction process (H-Coal) and another two-stage process [Integrated Two-Stage Liquefaction (ITSL)]. The 625°F EP CTSL oil was easier to upgrade than the other syncrudes because of its relatively low EP, and low heteroatom and high hydrogen contents. Both of the CTSL syncrudes were upgraded in a single hydrotreating step to diesel fuel, jet fuel, and a naphtha suitable for catalytic reforming. However, for the higher EP syncrude, the preferred refining route also required either a hydrocracking step or a second hydrotreating step. In general, products from two-stage liquefaction processes were easier to upgrade than those from single-stage processes. However, with all of the syncrudes, relatively small increases in EP made the oils more difficult to hydrotreat. Transportation fuels of given boiling ranges made from all of the syncrudes were fairly similar. Mainly, they were composed of cyclic hydrocarbons. There were, however, differences in product distributions, depending on syncrude boiling ranges. The middle-distillate fuels (jet and diesel) had high densities and, therefore, high volumetric energy contents. 9 refs., 6 figs.

8388 **(DOE/MC/19122—2521) Advanced development of a pressurized ash agglomerating fluidized-bed coal gasification system: Topical report, Process analysis, FY 1983.** (KRW Energy Systems, Inc., Madison, PA (USA)). 31 Jul 1987. Contract AC21-82MC19122. 260p. NTIS, PC A12; 3; GPO Dep. Order Number DE88002932/JAW.

KRW Energy Systems, Inc., is engaged in the continuing development of a pressurized, fluidized-bed gasification process at its Waltz Mill Site in Madison, Pennsylvania. The overall objective of the program is to demonstrate the viability of the KRW process for the environmentally-acceptable production of low- and medium-Btu fuel gas from a variety of fossilized carbonaceous feedstocks and industrial fuels. This report presents process analysis of the 24 ton-per-day Process Development Unit (PDU) operations and is a continuation of the process analysis work performed in 1980 and 1981. Included is work performed on PDU process data; gasification; char-ash separation; ash agglomeration; fines carryover, recycle, and consumption; deposit formation; materials; and environmental, health, and safety issues. 63 figs., 43 tabs.

8389 **(DOE/MC/19122—2522) Advanced development of a pressurized ash agglomerating fluidized-bed coal gasification system: Phase 2, Final report, May 1, 1983-July 31, 1984.** (KRW Energy Systems, Inc., Madison, PA (USA)). 15 Sep 1987. Contract AC21-82MC19122. 119p. NTIS, PC A06/MF A01; 1; GPO Dep. Order Number DE88002933/JAW.

KRW Energy Systems Inc. is engaged in the development of a pressurized, fluidized-bed, gasification process at its Waltz Mill Site in Madison, Pennsylvania. The overall objective of the program is to demonstrate the viability of the KRW process for the environmentally acceptable production of low- and medium-Btu fuel gas from a variety of fossilized, carbonaceous feedstocks for electrical power generation, substitute natural gas, chemical feedstocks, and industrial fuels. This report covers Phase II of the contract period (May 1, 1983 to July 31, 1984) and is a continuation of the work performed in 1983 and reported in the Phase I final report, FE-19122-30. Included is work performed in fiscal 1983 to 1984 on PDU testing, process analysis, cold flow scaleup facility, process and component engineering and design, and laboratory support studies.

8390 **(DOE/MC/21108—2505) Management of coal waste by energy recovery: Mild gasification of coal preparation wastes: Final report.** Chu, C.I.C.; Gillespie, B.L. (UCC Research Corp., Bristol, VA (USA)). Oct 1986. Contract AC21-84MC21108. 110p. NTIS, PC A06/MF A01; 1; GPO Dep. Order Number DE88001013/JAW.

This final technical report documents the technical effort completed over roughly two year period by UCC Research Corporation (UCCRC) on the research program sponsored by the Department of Energy (DOE) to recover the energy value of coal preparation plant wastes by the Mild Gasification Process. The major tasks of the project included a literature survey to characterize current and potential future techniques available for managing coal wastes in an economical and environmentally sound manner; selecting and characterizing feedstocks to be tested in the Mild Gasification Process Development Unit (MGU); building and modifying, if necessary, the MGU; conducting the test runs according to

a test plan; and analyzing the test results to assess system performance and to recommend if any further process research and development is warranted. About 50% of the coal liquids were obtained during the first hour and 90% of the liquids were collected within three hours of coal residence time. The optimum coal pyrolysis temperature for best liquid yield and liquid quality was found to be about 1100°F, which is in agreement with most workers in the pyrolysis field. The <600°F B.P. fraction is unique in that it contains mostly monocyclic (20.5%) and dicyclic (71.5%) aromatic material and thus is an excellent precursor for high density fuel. 44 refs.

8391 **(DOE/MC/23087—2504) Study of ammonia removal in coal gasification processes, literature review: Topical report.** Krishnan, G.N.; Wood, B.J.; Sanjurjo, A. (SRI International, Menlo Park, CA (USA)). May 1987. Contract AC21-86MC23087. 68p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE88001012/JAW.

In the combustion and gasification of coal, oxides of nitrogen (NO/sub x/) are formed from two sources: fixation of atmospheric nitrogen in high-temperature flames, and oxidation of nitrogen compounds that are part of the coal feedstock. Because US coals contain from 0.5 to 2 wt % nitrogen, the possible contribution of this source to NO/sub x/ emissions is not trivial. In the reducing environment near the exit of a gasifier, fuel-bound nitrogen appears largely as ammonia. Removal of ammonia from the hot coal gas will eliminate subsequent production of NO/sub x/ from the fuel-bound nitrogen in downstream appliances such as a gas turbine or a molten carbonate fuel cell. A comprehensive survey was performed of the scientific literature, patents, and government and industrial reports to determine process concepts that might be suitable for hot coal gas ammonia removal. Candidate ammonia removal processes resulting from the survey include: catalytic decomposition of ammonia; sorption/reaction of ammonia with metals and oxides; partial oxidation of ammonia to nitrogen; and staged combustion processes. Catalytic decomposition and staged combustion were judged to be the only processes with potential practical utility. A process based on catalytic decomposition will be independent of coal gas end use. Staged combustion methods can be used to reduce ultimate NO/sub x/ emissions during oxidation of NH_3-containing coal gas, but they require modifications in the combustion process that may impair efficient energy use of the fuel for further testing. 112 refs., 12 figs., 6 tabs.

8392 **(DOE/PC/40811—8) Role of temperature, solvent, and agitation in coal dissolution and liquefaction: Final report for the period September 1, 1981-February 28, 1986.** Briggs, D.E.; Bodde, W.S.; Ebnesajjad, S.; Ha, B.; Koh, Jung-Sik; Pak, Jong-Tae. (Michigan Univ., Ann Arbor (USA)). Aug 1987. Contract FG22-81PC40811. 274p. NTIS, PC A12/MF A01; 1; GPO Dep. Order Number DE87014549/JAW.

Experimental studies were effected in a 1-liter batch reactor to determine the role of the temperature, solvent, and agitation on the dissolution of Kentucky No. 9, Illinois No. 6, and Upper Wyodak coals. The goal was to increase the dissolution yield, defined as conversion of coal to pyridine-soluble material, while decreasing the hydrogen consumption. The "optimum" solvent for the bituminous coals was a "heavy solvent." The "heavy solvent" was effective for liquefaction of the Upper Wyodak coal, but additional hydroaromatic components in the solvent would be beneficial. While the Upper Wyodak coal swells in solvent mixtures, it did not exhibit evidence of the gel state. The maximum conversion under the conditions studied was 84 wt % DMMF coal at 400°C for 60 minutes in the "heavy solvent." 24 refs., 74 figs., 16 tabs.

8393 **(DOE/PC/70002—T2) Coal liquefaction co-processing: Topical report No. 1.** Luebke, C.P.; Nafis, D.A.; Humbach, M.J.; Gatsis, J.G.; Nelson, B.J.; Lea, C.L. (UOP, Inc., Des Plaines, IL (USA); Allied-Signal, Inc., Des Plaines, IL (USA). Engineered Materials Research Center). 1 Jun 1987. Contract AC22-84PC70002. 209p. NTIS, PC A10/MF A01; 1; GPO Dep. Order Number DE88000803/JAW.

This is the first topical report for the UOP Coal Liquefaction Co-processing Project. The UOP co-processing scheme is a single-stage slurry catalyzed process in which the petroleum vacuum resid and coal are simultaneously upgraded to a high quality synthetic oil. Hydrogen, finely ground coal, petroleum resid and catalyst are mixed, heated and then directed to a single-stage reactor where the simultaneous conversion of the resid and coal occurs. The reactor effluent is directed to a series of separators where a hydrogen-rich gas is recovered and recycled back to the reactor inlet. The balance of the material is sent to a series of separators where the light gases, light oil, vacuum gas oil (VGO), catalyst, unconverted coal, ash and residues are recovered. The catalyst is recycled back to the reactor. The UOP co-processing scheme is designed to be integrated with a conventional petroleum refinery. The hydrocarbon products from the co-processing unit will be sent to the refinery for final upgrading to finished products. 5 refs., 15 figs., 28 tabs.

8394 **(DOE/PC/70799—T10) Identification of nonvolatile coal derived products via chromatography coupled with on-line FTIR detection: Quarterly progress report for the period December 1, 1986-February 28, 1987.** Taylor, L.T. (Virginia Polytechnic Inst. and State Univ., Blacksburg (USA)). Nov 1987. Contract FG22-84PC70799. 20p. NTIS, PC A03/MF A01; GPO Dep. Order Number DE88002045/JAW.

The analysis of nonvolatile coal-derived liquefaction products for minor and trace components which contain nitrogen, oxygen or sulfur presents unique challenges. This proposal builds upon our efforts regarding the interfacing of Fourier transform infrared spectrometry with size exclusion and normal phase chromatography for the analysis of coal-derived products. The utility of sulfur hexafluoride as a SF mobile phase using various packed LC columns was investigated. The use of SF_6 for the separation of aromatic hydrocarbons is presented. The retention time of model mixtures is used to compare SF_6 with CO_2 under corresponding chromatographic conditions. 14 refs., 7 figs.

8395 **(DOE/PC/80009—T20) Cooperative research in coal liquefaction infratechnology and generic technology development: Final report, October 1, 1985 to December 31, 1986.** Sendlein, L.V.A. (Kentucky Univ., Lexington (USA). Inst. for Mining and Minerals Research). 29 Jun 1987. Contract FC22-85PC80009. 224p. NTIS, PC A10/MF A01; 1; GPO Dep. Order Number DE87014387/JAW.

During the first year of its research program, the Consortium for Fossil Fuel Liquefaction Science has made significant progress in many areas of coal liquefaction and coal structure research. Research topics for which substantial progress has been made include integrated coal structure and liquefaction studies, investigation of differential liquefaction processes, development and application of sophisticated techniques for structural analysis, computer analysis of multivariate data, biodesulfurization of coal, catalysis studies, co-processing of coal and crude oil, coal dissolution and extraction processes, coal depolymerization, determination of the liquefaction characteristics of many US coals for use in a liquefaction database, and completion of a retrospective technology assessment for direct coal liquefaction. These and related topics are discussed in considerably more detail in the remainder of this report. Individual projects are processed separately for the data base.

8396 (DOE/PC/80009—T20, pp 10-52) **Biologically improved coal structure for better liquefaction of coal.** Aleem, H.M.I.; Kermode, R.I.; Bhattacharyya, D.; Selegue, J.P.; Hamrin, C.E. Jr.; Schrodt, J.T. 29 Jun 1987. NTIS, PC A10/MF A01. Order Number DE87014387/JAW.

In Cooperative research in coal liquefaction infratechnology and generic technology development: Final report, October 1, 1985 to December 31, 1986.

Objectives of this project were (1) to identify and quantify those factors which are responsible for the rate and extent of microbial removal of inorganic and organic sulfur in coal, to establish the potential liquefaction characteristics of the coal after being subjected to low pH microbial treatment, and to identify a microorganism which is capable of removing nitrogen heteroatoms from coal. (2) To synthesize a labile p-xylene complex and several derivatives for evaluation as coal liquefaction catalysts, to characterize the above compounds, and to compare homogeneous coal liquefaction catalysts in tubing bomb experiments. 47 refs., 2 figs., 10 tabs.

8397 (DOE/PC/80009—T20, pp 53-78) **Co-processing of coal with heavy oil and petroleum residuals.** Shah, Y.T.; Wender, I. (Univ. of Pittsburgh, PA). 29 Jun 1987. NTIS, PC A10/MF A01. Order Number DE87014387/JAW.

In Cooperative research in coal liquefaction infratechnology and generic technology development: Final report, October 1, 1985 to December 31, 1986.

Co-processing may indeed be the bridge that leads to a new process for the direct liquefaction of coal. A remarkable synergism has been found when coal slurried in heavy oil is treated under coal liquefaction conditions. Coking is inhibited and heavy metals are relegated to the pitch fraction. The product is easy to upgrade to distillates. An understanding of the role of coal in inhibiting the thermal foundation of coke upon addition of coal to heavy oils would be of great benefit in evolutionary advances in present processes for the direct liquefaction of coal. 4 refs., 14 figs., 5 tabs.

8398 (DOE/PC/80009—T20, pp 79-95) **Liquefaction research in pyrolysis, catalysis and coal dissolution.** Bajura, R.A.; Penn, J.H.; Dalal, N.S.; Seehra, M.S.; Jagodzinski, P.W.; Stiller, A.H.; Mintz, E.A.; Zondlo, J.W. (West Virginia Univ., Morgantown). 29 Jun 1987. NTIS, PC A10/MF A01. Order Number DE87014387/JAW.

In Cooperative research in coal liquefaction infratechnology and generic technology development: Final report, October 1, 1985 to December 31, 1986.

A novel extraction procedure has been developed which utilizes a specialized solvent/antisolvent system to extract organic material from bituminous coals. The procedure is carried out at atmospheric pressure and relatively low temperature (202°C). The extracted product is recovered as a solid in good yield and is found to contain essentially no ash and a reduced concentration of sulfur species. The process is particularly effective with high ash coals containing large amounts of pyritic sulfur. A parametric study involving some of the main independent variables has been completed and has yielded data which are useful for preliminary process design. 8 refs., 1 fig., 9 tabs.

8399 (DOE/PC/80009—T20, pp 96-121) **Integrated coal liquefaction/characterization.** Hill, G.R.; Meuzelaar, H.L.C.; Anderson, L.L.; Pugmire, R.J.; Eyring; E.M.; Windig, W.; Grant, D.M.; Wiser, W.H. (Univ. of Utah, Salt Lake City). 29 Jun 1987. NTIS, PC A10/MF A01. Order Number DE87014387/JAW.

In Cooperative research in coal liquefaction infratechnology and generic technology development: Final report, October 1, 1985 to December 31, 1986.

Objectives of this project were: (1) to generate urgently needed information on composition and concentration of hydrocarbon-rich components, e.g., resinites and sporinites, in carefully selected and prepared coals. (2) To develop novel, efficient extraction and liquefaction methods for these hydrocarbon components which will produce a high quality hydrocarbon product as well as a commercially valuable residue. The more efficient extraction and liquefaction methods will include investigation of new reaction regimes such as mild (below the softening temperature of coals) temperatures, and/or the use of selective site- or bond-specific catalysts. (3) To perform a detailed analysis of the hydrocarbon rich coal liquids obtained using advanced spectroscopic methods and an integrated data analysis approach. (4) To develop improved numerical techniques for data correlation and reduction as well as for computer modeling of extraction and liquefaction processes (infratechnology development). 14 figs., 9 tabs.

8400 (DOE/PC/80009—T20, pp 218-222) **Coal liquefaction infratechnology and generic technology: Integration and database development.** Huggins, F.E.; Huffman, G.P. 29 Jun 1987. NTIS, PC A10/MF A01. Order Number DE87014387/JAW.

In Cooperative research in coal liquefaction infratechnology and generic technology development: Final report, October 1, 1985 to December 31, 1986.

The coal liquefaction technology database/network is viewed as one means to integrate activities of the various research groups involved in the CFFLS project. The database/network will enable the different groups to share and exchange information and will provide electronic mail for rapid communication and report transfer between groups. The database/network will be hosted at the University of Kentucky on an AT & T 3B20 mainframe computer in the School of Engineering. This computer, which uses UNIX as the operating system, has more than 1.8 Gbytes of memory and is currently accessible by modems from remote locations. 2 figs.

8401 (DOE/PC/80908—5) **Low severity coal conversion by ionic hydrogenation: Report for the period July 1 to September 30, 1987.** Cheng, J.C.; Maiorielio, J.; Larsen, J.W. (Lehigh Univ., Bethlehem, PA (USA). Dept. of Chemistry). 14 Oct 1987. Contract FG22-85PC80908. 12p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88001302/JAW.

Triphenylmethanol and 1-methoxynaphthalene were used as prototypical systems in the search for catalysts which were small and soluble in BF_3:H_2O. The use of small catalysts will minimize potential mass transport problems when coals are employed as substrates for ionic hydrogenation in BF_3:H_2O. The best catalyst found was $(CH_3CN)_3PtCl_3$. It is soluble in BF_3:H_2O. A variety of ethers, polynuclear aromatic (PNA) compounds, and other molecules were studied in order to extend our knowledge of the scope of this H_2/$(CH_3CN)_3PtCl_3$/BF_3:H_2O reaction system. Naphthalene was not reduced by BF_3:H_2O-Et_3SiH^3 but was completely reduced to decalin by this reaction indicating the stronger hydrogenating power of this system. Phenanthrene, anthracene and chrysene were only partially reduced. One problem was the low solubility of these PNA compounds in BF_3:H_2O. 1-Naphthoic acid was not reduced under standard reaction conditions, and dibenzofuran showed rather low reactivity. Results indicated that large PNAs are not easily reduced under our standard reaction conditions. Therefore the reaction variables (temperature, hydrogen preasure, catalyst, etc.) will be optimized in the following quarter. 9 refs., 1 tab.

8402 (EPRI-AP—5466-SR) **Economics of phased gasification-combined-cycle plants: Utility results: Special report.** Adjemian, K.; Athas, J.; Betley, F.; Crumley, T.; Ferrier, C.; Fleming, K.; Kaelin, T.; Lang, J.; Lewis, A.; Rasmussen, J. (Electric Power Research Inst., Palo Alto, CA (USA)). Nov 1987. 143p. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88920088/JAW.

This report was written by seven utility authors from the Utility Coal Gasification Association in collaboration with EPRI. It provides an overview of the economic merit of the phased construction of gasification-combined cycles based upon the production cost evaluations, fixed charge assessments and financial analyses of each of the seven utility authors. Other features of phased GCC construction which affect utility planning decisions are also discussed. 33 figs., 41 tabs.

8403 (IS—4847-Rev.2) **Beneficiation of Korean anthracite in a heavy-medium cyclone.** Birlingmair, D.H.; Fisher, R.W.; Killmeyer, R.P. (Ames Lab., IA (USA); USDOE Pittsburgh Energy Technology Center, PA). Feb 1987. Contract W-7405-ENG-82. 83p. NTIS, PC A05/MF A01; 1; GPO Dep. Order Number DE88001561/JAW.

A performance test to beneficiate low-grade Korean anthracite was conducted using a heavy-medium cyclone to determine the quality and efficiencies attainable. Two preliminary runs were made at heavy-medium densities of 1.986 and 2.215 to bracket the desired level of cleaning and provide data for predicting the density required to produce the desired product. A test was then completed to demonstrate that the coal could be beneficiated to the desired level utilizing a heavy-medium cyclone system. This work was done in support of a feasibility study for the Korean Institute of Energy and Resources (KIER) to develop means for greater utilization of low quality Korean coal deposits under a Memorandum of Understanding between US DOE and the Korean Ministry of Science and Technology. The test results demonstrated that the raw coal with 71.9% ash and 1803 kcal/kg (3245 Btu/lb) could be beneficiated to obtain a product with 40.6% ash and 4299 kcal/kg (7738 Btu/lb) while recovering 85.5% of the heating value. A weight recovery of 35.9% was attained while the reject material had a heating value of 406 kcal/kg (731 Btu/lb). 5 figs., 3 tabs.

8404 **(NP—8750529) Conversion of methanol to gasoline. Design, construction and operation of a demonstration plant. Final report.** Avidan, A.; Gierlich, H.H.; Thiagarajan, N. (Union Rheinische Braunkohlen Kraftstoff A.G., Wesseling/Koeln (Germany, F.R.); Mobil Research and Development Corp., Paulsboro, NJ (USA); Uhde (F.) G.m.b.H., Dortmund (Germany, F.R.); Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). Aug 1986. 62p. (In German). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88750529/JAW.

The fluid-bed processes for the conversion of Methanol To Gasoline (MTG) and Methanol To Olefins (MTO) were successfully demonstrated in a BPD semi-works plant in Wesseling, Federal Republic of Germany. The 6-year project was a joint effort by Mobil Research and Development Corporation, Uhde GmbH and Union Rheinische Braunkohlen Kraftstoff AG. The project was supported by the industrial participants, and the governments of the Federal Republic of Germany and the United States of America. Following full-scale cold flow model studies at Paulsboro, New Jersey and nearly one year of construction, operation of the plant was started in December, 1982. Accumulating 12200 hours onstream, the plant showed excellent performance and all design goals were met. The successful scale-up from bench-scale units, and a 4 BPD pilot plant, was confirmed. The final outcome of 8600 hours of MTG tests was a conceptual commercial design for a coal to gasoline plant, incorporating a fluid-bed MTG section. Product yields per tonne of hard coal were 325 kg of gasoline, 14.3 kg of propane, and 30.7 kg of sulfur. The thermal efficiency calculated was 93% for the MTG section and 49% for the entire plant. During 3600 hours of MTO operation an extensive data base for a commercial design could be won. Methanol conversion and olefin yield were equal at comparable operating conditions in the 4 BPD pilot plant and the demonstration plant. The combination of the MTO process with an olefin oligomerization process (e.g. Mobils MOGD process) opens the way for the simultaneous production of high quality gasoline and diesel fuel. With 48 refs., 31 figs..

8405 **(ORNL/TM—10637) A review of thermolysis studies of model compounds relevant to processing of coal.** Poutsma, M.L. (Oak Ridge National Lab., TN (USA)). Nov 1987. Contract AC05-84OR21400. 228p. NTIS, PC A11/MF A01; 1; GPO Dep. Order Number DE88003690/JAW.

The bond breaking, bond making, rearrangement, and hydrogen transfer reactions that occur in coal at ~350 to 1000°C largely involve transient free radicals as reactive intermediates. However, the structural complexity and heterogeneity of coal has hampered development of detailed reaction mechanisms at the molecular level. Studies of the thermolysis and hydrogenolysis of model compounds, chosen to represent individual structural units in coal, provide very useful input toward that goal. These are selectively and critically reviewed in this report. Emphasis is placed on recent quantitative studies of product composition and kinetic behavior that have been carried out at low extents of conversion. The classes of organic structures covered are alkanes; aromatic hydrocarbons; alkylaromatics; α,ω-diphenylalkanes, Ph(CH_2)/sub n/Ph (n = 0 to 4), and their analogs with a CH_2 group replaced by O, S, or NH; hydroaromatics; phenols, alkylphenols, and aryl ethers; and carbonyl compounds. Thermal behavior of pure model compounds is reviewed along with its perturbation by added hydroaromatics or molecular hydrogen. Structure-reactivity patterns within each class are illustrated whenever possible. Coverage is divided arbitrarily into a "low-temperature regime," ~300 to 450°C and a "high-temperature regime," ~600 to 900°C dominated by gas-phase studies. Extensive use is made of the methodology of thermochemical kinetics. Several discrepancies between literature data or suggested mechanisms and predictions based on currently accepted thermochemistry of free radicals and kinetic expressions for prototypical elementary free radical reactions are pointed out. Inversely, certain mechanistic hypotheses offered herein require experimental evaluation. 303 refs., 19 tabs.

8406 **Fossil fuel furnace reactor.** Parkinson, W.J. (to Dept. of Energy, Washington, DC). US Patent 4,706,581. 17 Nov 1987. Filed date 31 Oct 1986. vp. Patent and Trademark Office, Box 9, Washington, DC 20232.

A fossil fuel furnace reactor is described, comprising: an interior reaction vessel for containing a batch of sample material having a fossil fuel content. The reaction vessel has a wall thickness effective for heat transfer at a predetermined rate to simulate a process temperature history for a selected continuous processing plant for the fossil fuel; a heater jacket disposed about the reaction vessel and defining independent controllable temperature zones axially spaced along the reaction vessel; and a pressure vessel insulatingly disposed about the heater jacket and defining a wall thickness effective to contain an operating pressure functionally selected to simulate the continuous processing plant.

8407 **Hydroprocessing of coal-derived residuum.** Stiegel, G.J.; Thomas, N.J.; Warzinski, R.P.; Tischer, R.E. (Pittsburgh Energy Technology Center, U.S. Dept. of Energy, Pittsburgh, PA 15236). *Industrial and Engineering Chemistry Research;* **26**: No. 9, 1865-1868(Sep 1987).

Catalytic hydroprocessing of coal-derived residuum is typically performed in the presence of a distillate solvent to minimize experimental problems associated with high-boiling materials; however, this limits the amount of useful information that can be obtained on the reactivity of the residuum itself. In the present investigation, an ash-containing coal-derived residuum was catalytically hydrotreated in the absence of a solvent in a batch microreactor to obtain information regarding the hydrogenation-dehydrogenation equilibrium of the residuum. The residuum was also separated into five fractions by using a novel supercritical fluid procedure, and the reactivity of each fraction was determined. Little difference was observed in the hydrogenation reactivity of the five fractions, but differences were observed in the removal of heteroatoms.

8408 **Effect of sodium impregnation on catalyst performance when hydrotreating a coal-derived liquid.** Baker, J.R.; Mc Cormick, R.L.; Haynes, H.W. Jr. (Dept. of Chemical Engineering, Univ. of Wyoming, Laramie, WY 82071). *Industrial and Engineering Chemistry Research;* **26**: No. 9, 1895-1900(Sep 1987).

A commercial Ni-Mo/alumina catalyst was loaded with percentage quantities of sodium and tested for activity and activity maintenance while hydrotreating a coal-derived distillate under high severity conditions. The original catalyst exhibited a large high-temperature peak during the temperature-programmed desorption of tert-butylamine. This peak, which is an indicator of catalyst acidity, was reduced and ultimately eliminated by impregnating the catalyst with increasing amounts of sodium. At 5 wt % Na/sub 2/O, no acid peak remained. The sodium loadings had little effect on activity or activity maintenance for hydrogen uptake or specific gravity reduction as compared to the original catalyst. The hydrodenitrogenation activity was reduced, however. Activity maintenance for both the original catalyst and the sodium-treated catalyst was excellent, so it was not possible to observe an effect of sodium addition on activity decline. The sodium-loaded catalyst was coked to a lesser extent than the original catalyst.

8409 **Kinetics of vapor-phase secondary reactions of prompt coal pyrolysis tars.** Serio, M.A.; Peters, W.A.; Howard, J.B. (Advanced Fuel Research, Inc., East Hartford, CT 06118). *Industrial and Engineering Chemistry Research;* **26**: No. 9, 1831-1838(Sep 1987).

The kinetics of vapor-phase secondary reactions of newly formed coal pyrolysis tars were studied at temperatures and residence times of 500-900°C and 0.6-3.9 s, respectively. Tar vapors, generated by heating a helium-swept, shallow packed bed of Pittsburgh No. 8 bituminous coal from room temperature to 550°C, at 3°C/min, were either rapidly conveyed to collection traps for subsequent characterization or else passed through an adjacent reactor for controlled thermal treatment prior to trapping. Results are described. A multiple, independent, parallel, first-order reaction model also performed well but could not predict step-like behavior in conversion at 0.6-s residence time. A single-reaction first-order decomposition model correlated the conversion data poorly at 0.6- and 1.1-s residence times, and use of the resulting best fit parameters gave totally inadequate predictions of conversions measured at 2.5 and 3.9 s.

8410 **Catalytic tar conversion in coal gasification systems.** Baker, E.G.; Mudge, L.K. (Battelle Pacific Northwest Labs., Richland, WA 99352). *Industrial and Engineering Chemistry Research;* 26: No. 7, 1390-1394(Jul 1987).

Catalysts for coal tar conversion were tested in a fixed-bed catalytic reactor. Tar and water were mixed with a fuel gas to simulate coal gas from a fixed-bed gasifier. Tests were conducted at 450-690°C, 1010-1810 kPa, and 1-8-s residence time. Acid cracking catalysts were found to be the most effective of the catalysts tested. Coke was a primary product, and periodic regeneration was required to maintain catalyst activity. Hydrocracking catalysts containing CoMo, NiW, and Pd reduced the coke yield from tar cracking but did not reduce the rate of catalyst deactivation.

0105 By-products

8411 **(CONF-871041—2) Prediction of deposition/corrosion/erosion.** Ahluwalia, R.K.; Hajduk, J.C.; Im, K.; Kim, S.W.; Kumar, R.; Liu, Y.Y.; Majumdar, S.; Myles, K.M.; Natesan, K.; Tam, S.W. (Argonne National Lab., IL (USA)). 1987. Contract W-31109-ENG-38. 3p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE88002968/JAW.

From Advanced research and technology development direct utilization; Morgantown, WV, USA (13 Oct 1987).

The purposes of this program are to develop a validated analytical capability (methodology) to understand the process environmental conditions, and to predict long-term corrosion/erosion behavior of structural materials in advanced fossil technologies (e.g., gasification, direct coal-fired heat engines, advanced pulverized coal-fired boilers) under development by the Department of Energy (DOE). The program would (1) develop mathematical (analytical) formalisms that predict interaction of coal-derived gases and particle-laden flows with materials of construction of elevated-temperature components used in fossil energy systems; (2) experimentally verify the formalisms with existing data derived from PDUs and with data derived from specific experiments in well-controlled environments in laboratory facilities; and (3) apply the validated methodology models in the prediction of long-term corrosion/erosion behavior of construction materials as a function of coal feedstock chemistry and system operating conditions. The outcome of this program - a validated analytical methodology for predicting material performance - would be directly applicable for resolving critical technology-specific problems, such as deposition and corrosion damage at elevated metal temperatures in p-c boilers, corrosion/erosion degradation in direct coal-fired gas turbines, severe erosion in FBC systems, and hot corrosion/erosion damage in turbines of coal gasification combined cycle, and cogeneration plants.

0106 Properties

REFER ALSO TO CITATION(S) 8375, 8394, 8411, 8427

8412 **(CEA-N—2524) Determination of ash content of coal using nuclear borehole logging spectrometric gamma-gamma technique.** Miehe, J.M. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Dept. d'Electronique et d'Instrumentation Nucleaire). Jun 1987. 189p. (In French). NTIS (US Sales Only), PC A09/MF A01. Order Number DE88751569/JAW.

During the past decade, increasing effort has been given to monitoring coal quality in the search, production and preparation sequence. Considerable research and development has been carried out on nuclear methods for determination of ash in coal. A number of nuclear techniques are now well established for coal analysis. In particular, the spectrometric gamma-gamma technique is based on the existence of a simple correlation between the ash content and the equivalent atomic number of coal. This technique records and uses the count rates of the backscatter spectrum. These count rates describe the changes in spectral shape which are due to ash content variations. This method is presented along with a short review of the physical background. The report includes the simulation of in situ borehole probe readings using a MONTE CARLO tracking program. Simulating the transport through matter of gamma-rays by MONTE CARLO techniques essentially attempts to reproduce the actual statistical nature of the interaction processes. Random numbers are used throughout, along with known nuclear data, to select the parameters which influence a particle's history. Such an approach can deal with complex geometries through which the particles move. Biaising or weightening techniques are applied for variance reduction, so as to minimise the statistical errors. The basic features of biaising as well as the description of the program are given. A semi-theoretical approach is discussed for the determination of ash content of coal seam using the simulated spectrum.

8413 **(CONF-8705114—6) A new internal standard for pyrolysis-MS [mass spectrometry] of fossil fuels.** Winans, R.E.; Scott, R.G.; McBeth, R.L. (Argonne National Lab., IL (USA)). 1987. Contract W-31109-ENG-38. 2p. NTIS, PC A02. Order Number DE88003128/JAW.

From 35. conference on mass spectrometry and applied topics; Denver, CO, USA (24 May 1987).

Purpose of this study is to develop a reliable internal standard for pyrolysis mass spectroscopy of coals. The standard must volatilize at 200 to 500°C, give high yields with little degradation or polymerization, yield mostly a single fragment ion or molecular ion, and this ion should have a precise mass different from those found in coal pyrolysis products. The standard is a Diels-Alder adduct synthesized from perdeuteroanthracene and maleic anhydride. (DLC)

8414 **(CRIEPI-U—86030) Effects of production temperature on solubility and fertilizer effectiveness.** Aoki, M.; Umezawa, T. (Central Research Inst. of Electric Power Industry, Tokyo (Japan)). Mar 1987. 24p. (In Japanese). Central Research Institute of Electric Power Industry, Tokyo, Japan.

Potassium silicate fertilizer is studied for the utilization of ash produced by coal fired power plant and development of slow-effecting fertilizer. In this paper, the effects of baking condition during production on solubility in weak acid solution and the response of crops to fertilization, were reported. Response of crops to fertilization was better when potassium silicate was baked at low temperatures (800 degrees C) and when the fertilizer had high solubility in weak acid solution. 10 refs., 9 figs., 14 tabs.

8415 **(DOE/PC/60015—T2) Separation and characterization of coal derived components: Final technical progress report.** Hurtubise, R.J.; Silver, H.F. (Wyoming Univ., Laramie (USA)). 2 Oct 1987. Contract AC22-83PC60015. 103p. NTIS, PC A06/MF A01; 1; GPO Dep. Order Number DE88000722/JAW.

Several high-performance liquid chromatographic methods were developed for the separation of polycyclic aromatic hydrocarbons, nitrogen compounds and hydroxyl aromatics. Methods were then modified and applied to the separation of polycyclic aromatic hydrocarbons, nitrogen compounds, and hydroxyl aromatics in non-distillable Kentucky and Wyodak coal-liquid samples. Very good compound class separation was obtained for the various compound classes in the oils, asphaltenes, and chloroform-soluble preasphaltenes. Compound-classes were characterized by field-ionization mass spectrometry, infrared spectrometry, proton nuclear magnetic resonance spectrometry, and elemental analysis. 29 refs., 13 figs., 18 tabs.

8416 **(DOE/PC/70801—T12) Thermodynamic properties for supercritical coal conversion: Final report, August 20, 1984-August 20, 1987.** Eckert, C.A. (Illinois Univ., Urbana (USA). Dept. of Chemical Engineering). 1987. Contract FG22-84PC70801. 13p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88001567/JAW.

The objectives of this research were the understanding of supercritical fluid behavior and the development of supercritical fluid (SCF) processes for coal conversion. Specifically we were measuring solubilities of representative coal compounds in an attempt to model the pertinent thermodynamics. This information will eventually be used to design processes to remove sulfur from coal or actually react the coal compounds to form more useful products. 1 fig., 1 tab.

8417 (DOE/PC/80009—T20, pp 122-200) **Basic process/resource evaluation task.** Davis, B.H.; Keogh, R.A.; Poe, S.H.; Tsai, K.; Taghizadeh, K.; Hardy, R.; Goodman, J.; Chawla, B.; Taulbee, D.; Pollock, J.D. (Kentucky Energy Cabinet Lab., Lexington, KY). 29 Jun 1987. NTIS, PC A10/MF A01. Order Number DE87014387/JAW.

In Cooperative research in coal liquefaction infratechnology and generic technology development: Final report, October 1, 1985 to December 31, 1986.

A systematic evaluation of the relationship between basic characteristics of the feedstock resources and their subsequent behavior under various process conditions have been carried out at the Kentucky Energy Cabinet Laboratory (KECL). This program generated a substantial data base that is available to emerging liquefaction technologies. Ultimately, this effort will provide an industrial concern sufficient information to optimize feedstock selection for a number of processes. The current year's activities include the following major tasks: (1) characterization of the coals of the western Kentucky coal field, (2) survey of coal conversions in small scale reactors, and (3) reactor product characterization. 66 refs., 51 figs., 6 tabs.

8418 (DOE/PC/80532—10) **The effect of propane on atomic spectrometric signals in the direct current plasma.** McCreary, T.W.; Long, G.L. (Virginia Polytechnic Inst. and State Univ., Blacksburg (USA). Dept. of Chemistry). 1987. Contract FG22-85PC80532. 26p. (CONF-8710209—1). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88002457/JAW.

From 14. Federation of Analytical Chemistry and Spectroscopy Societies (FACSS); Detroit, MI, USA (1 Oct 1987).

The addition of small amounts of propane to the direct current plasma, DCP, affects the emission signal of analyte species in the plasma. In the normal analytical region of the plasma, a reduction in emission is seen; this reduction can be accounted for by a decrease in excitation temperature caused by the propane in this region of the plasma. Above the analytical region, an enhancement in atomic emission is seen. The excitation temperature in this region of the plasma was found to remain unchanged when propane was added. The mechanism for the enhancement is thought to be the reduction of metal oxides to the corresponding free metal by carbon. Evidence for the mechanism is provided by the fact that a large reservoir of atomic carbon exists in this region of the plasma, and by examination of the behavior of slurries of the metal oxides, introduced into the plasma via a Babington nebulizer.

8419 (NICR-SCOAL—8701) **A suggested rapid method for the determination of the liability to spontaneous combustion of coal.** Coetzee, S.D. (National Inst. for Coal Research, Pretoria (South Africa)). 1987. 15p. National Inst. for Coal Research, Pretoria, South Africa.

The liability of coal to undergo spontaneous combustion is simulated in the laboratory. The experiments explained are aimed at finding reaction changes in the coal which can be ascribed to oxidation or hydration of the coal substance during alternating wet and dry conditions. There is a brief discussion of the significant changes which were found in the mass of the dry coal over a period of 24 days which were ascribed to the liberation of carbon dioxide and water from the coal. at the same time heat arises which may cause spontaneous combustion of the coal.

8420 **Correlation of liquid chromatographic retention times with molecular structures of coal liquid components.** Burke, F.P.; Winschel, R.A. (Consolidation Coal Co., Library, PA). *Analytical Chemistry;* 59: No. 21, 2586-2593(1 Nov 1987). Contract AC05-79ET14503;AC22-84PC70018.

The retention times of the components of a distillable coal liquid (bp ca. 200-500 °C), separated by reversed-phase liquid chromatography (RPLC) using a C18 column, can be estimated based on a multiple linear regression correlation with 11 simple molecular structure descriptors. A stepwise methanol/water gradient was employed. The coal liquid components include alkylated and unalkylated aromatics, hydroaromatics and other naphthenoaromatics, heterocyclics, and phenols. A correlation retention times of the 0.989 was obtained. The predicted and observed retention times of the 153 components and groups of isomers differ by an average of 2.6 min in a 138-min RPLC separation. Improved accuracy (+/-2.0 min average) was obtained for a set of 37 model coal liquid compounds.

8421 **The premium coal sample program.** Vorres, K.S.; Marianelli, R.L. (Argonne National Lab.). pp 260 of Symposium proceedings: A national agenda for coal quality research. Garbini, S.; Schweinfurth, S.P. Alexandria, VA; U.S. Geological Survey (1986). (CONF-8504287—).

From Symposium on a national agenda for coal quality research; Reston, VA, USA (9 Apr 1985).

The Premium Coal Sample Program at Argonne National Laboratory will provide the coal-science research community with long-term supplies of a small number of premium coal samples that can be used as standards of comparison. These samples will be as chemically and physically identical as possible, have well-characterized chemical and physical properties, and will be stable over long periods of time. Coals will be selected, collected, transported, and processed into the desired particle and sample sizes, and sealed in environments as free of oxygen as possible. The samples will be checked for homogeneity, characterized in an extensive interlaboratory program, and then periodically monitored for stability. Samples will be distributed to researchers after the samples are characterized.

8422 **An automated microscopic method for the determination of pyrite size distributions in crushed coal.** Irdi, G.A.; Rohar, P.C. Littleton, CO; Society of Mining Engineers of AIME (1986). 12p. (CONF-8609178—). Society of Mining Engineers of AIME, Caller No. D, Littleton, CO 80127.

From Society of Mining Engineering of AIME fall meeting; St. Louis, MO, USA (7 Sep 1986).

Technical Paper 86-390.

An automated method of microscopy for determining the pyrite size distribution on two base coals that were crushed to 28 mesh x 0 has been developed. Polished epoxy-bound coal pellets were prepared and examined by a Zeiss IBAS image analyzer utilizing a program developed from provided software. Pyrite size distribution determination is considered a necessary first step in pyrite characterization that could lead to successful predictions, by microscopy, of a coal's theoretical pyritic sulfur removal. The authors' research efforts to date have indicated that the IBAS can be a reliable instrument for determining pyrite size distribution in crushed coal. A program was also developed to convert pyrite size data to a weight basis for comparisons to the results from chemical analyses. The problems encountered in their research and their solutions are presented in this discussion.

0108 Waste Management

REFER ALSO TO CITATION(S) 8414, 8432, 8677, 8771

8423 (CRIEPI—485008) **Study on the use of coal ash reclaimed land as a upland-fields (Part 3). Growth and mineral nutrition of cabbage and rakkyo in fly ash treated acid brown forest soil and sand.** Okabe, K.; Suganuma, H.; Aoki, M. (Central Research Inst. of Electric Power Industry, Tokyo (Japan)). Feb 1987. 42p. (In Japanese). Central Research Inst. of Electric Power Industry, Tokyo, Japan.

This study was carried out to promote the use of fly ash from coal-fired power plant as a treatment for soil. Acid brown forest soil was mixed with fly ash at 0-50% by volume, and sand was mixed with fly ash 0-26% by volume. Growth and mineral absorption in cabbage and rakkyo grown in soil mixed with fly ash were investigated. The results were as follows. (1) The growth and yield of cabbage increased in fly ash treated soil. This increase seemed to be due to increases in pH, boron and molybdenum absorption. (2) The growth and yield of rakkyo decreased in sand treated with fly ash. This seemed to be due to temporary fluctuation of dissolved components in soil. (3) pH and electrical conductivity of the fly ash treated soil decreased with the influence of rain. (4) In using this fly ash to treat soil, the suitable rate of mixing depends on the soil type. Low mixing rates are recommended for soil with low cation exchange capacity, while a higher rate can be

used for soils with a high cation exchange capacity . 13 refs., 8 figs., 20 tabs.

8424 **(CRIEPI-U—86022) Effective utilization of coal slag emitted at the process of coal gasification combined cycle power generation. Utilization as a cement admixture and fine aggregate.** Kuriyama, T.; Okuda, T. (Central Research Inst. of Electric Power Industry, Tokyo (Japan)). Feb 1987. 42p. (In Japanese). Central Research Inst. of Electric Power Industry, Tokyo, Japan.

Coal slag produced by coal gasification combined cycle power generation differs from conventional dust-like coal ash in shape, and is glassy, granulated, or needle-like as a result of fusion and solidification. An investigation was carried out into the effective use of coal-slag, obtained at the gasification experiment, as a cement mixture and fine aggregate for concrete. Ash content of coals used was 6.4-15.2%. The volume of ash (slag) was reduced to 1/5 - 1/7.5 in comparison with that of conventional dust coal ash. The main constituents were silica and alumina. These are the same as in the commercial fly ash, but the ratio of soluble part to alkali was somewhat larger. As an admixture, it is expected to have the same effects as the commercial fly ash. When the coal slag is used as a fine aggregate, the resulting concrete shows lower strength than normal at early ages, but after 28 days of age, has more than 300 kgf/cm^2 of compressive strength. Thus the coal slag can be used as an admixture and fine aggregate. Better results are obtained if blast furnace slag is added to the concrete. 2 refs., 18 figs., 19 tabs.

8425 **(EPRI-CS—5528) Specification guidelines for flue gas desulfurization rubber: Final report.** Cassidy, P. (Radian Corp., Austin, TX (USA); Texas Research Inst., Inc., Austin (USA)). Nov 1987. 150p. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88920101/JAW.

After investigating the historical performance (as of spring 1986) of rubber liners in 27 utility FGD systems and examining the causes of failures, Radian Corporation and Texas Research Institute developed user guidelines to assist in the selection and installation of rubber product systems. As part of the process, the utility should prepare a rubber lining technical job specification. This document will govern material selection and quality control measures and should include the general requirements, a description of the service conditions, rubber lining specification, technical requirements (for design, welding surface preparation, application, and inspection), and quality control requirements. Three generic classes of sheet rubber products have been commonly used as FGD liners: chlorobutyl, natural rubber, and neoprene. Of these, the rubber industry considers chlorobutyl to be the material of choice. Proposed rubber systems should be evaluated according to the utility's prior experience, objective test results in FGD systems, long-term FGD simulation tests, and accelerated screening tests as defined in this document. 49 refs., 9 figs., 9 tabs.

8426 **(SVF—233) Recycling of restproducts from SO_2-separation in low NO/sub x/ burners.** Karlsson, H. (Stiftelsen foer Vaermeteknisk Forskning, Stockholm (Sweden)). Jun 1986. 19p. (In Swedish). Stiftelsen foer Vaermeteknisk Forskning, Stockholm, Sweden.

A study was undertaken of ash products obtained from limestone injection in a low NO/sub x/ burner. The investigation focused on the use of the ashes as additives for cement production. It was established that the types of ash studied show the same behaviour as other types of ash. Furthermore, the added limestone generates calcium sulfate. The gypsum added to cement products can thus be replaced to some extent by the contribution from the ash products. Any conclusions concerning chlorine cannot be drawn, due to the low chlorine content of the coal fired. The chemical analyses revealed high levels of quartz, i.e. crystalline SiO_2. Furthermore, high concentrations of CaO may be anticipated. These aspects have to be considered in further investigations, especially when considering potential problems in the working environment.

0109 Environmental Aspects

REFER ALSO TO CITATION(S) 8443

8427 **(EPS—3-PG-9) Characterization of organic components in ash samples from pulverized coal-fired power generating stations.** (Zenon Environmental, Inc., Burlington, Ontario (Canada)). Feb 1987. 45p. Environmental Protection Publications, Conservation and Protection, Environment Canada, Ottawa, Ontario, Canada, K1A 0E7.

This study comprises 2 parts. The purpose of the first part was to continue previous analytical work which focussed primarily on trace organics in ash samples produced in high efficiency, pulverized coal-fired (PCF) power generating stations. Some analysis and discussion of bubbling atmospheric fluidized-bed combustion were also included for reference. The specific objectives were to determine the levels of polyaromatic hydrocarbons, polychlorinated dibenzo-rho-dioxins, and dibenzofurans fly ash samples from conventional PCF power generating stations; to characterize other organic contaminants present in selected ashes and assess total extractable organic chlorine as a surrogate measurement parameter; and to compare benzene and toluene sample extraction procedures for PAH in ash samples. The purpose of the second part of the study was to compile and document available information on trace organic contaminants in ashes from conventional PCF power generating stations including the results from the first part of this study, with particular emphasis on Canadian stations. 19 refs.

0110 Reserves And Exploration

REFER ALSO TO CITATION(S) 8430

8428 **(GSZ—101) Karoo stratigraphy in part of western Zambia; results of a reconnaissance coal exploration programme.** Johns, C.C. (Geological Survey of Zambia, Lusaka). 1986. 22p. Geological Survey of Zambia, Lusaka, Zambia.

Six diamond-drill boreholes sunk near the eastern margin of the Barntse basin in western Zambia gave considerable further detail of the Karoo succession. This, with new palaeontological and palynological information, enabled the development of a more refined stratigraphic subdivision of the Karoo Supergroup. The Lower Karoo Group strata rest on schists or on adamellite and comprise the Kafue Hook Basal Formation, Chunga Carconaceous Formation, Tatayoyo Argillite Formation and Kahare Siltstone Formation. The Upper Karoo Group comprises the Nkoya Grit Formation, Kato Mudstone Formation, Luena Sandstone Formation and, uppermost, the Batoka Basalt Formation. Kalanari Group sands overlie the Karoo rocks in the more westerly boreholes. The Karoo succession is similar to that found in neighbouring parts of Botswana and represents a complete but condensed succession as compared with successions in the other Karoo basins within Zambia. The maximum thickness of Karoo sediments beneath the Batoka Basalt Formation is estimated at about 525 m. There is evidence for Upper Karoo and post-Karoo faulting. Carbonaceous horizons were intersected in all boreholes except GS265 (not completed) and a 4.4 m (nominal thickness) seam of high-ash (24 per cent.) coal was encountered in borehole GS262. More information is needed before the general distribution and quality of coal in the area can be assessed.

0120 Mining

8429 (DOE/BC—87/2/SP, pp 27.1a-27.23) **Integrated, real-time, process-mapping instrumentation system.** Jul 1987. NTIS, PC A13/MF A01. Order Number DE87001217/JAW.

In Supporting technology for enhanced oil recovery: Third ammendment and extension to Annex IV enhanced oil recovery thermal processes.

Sandia has been involved in developing techniques to map geologic discontinuities for over ten years. To data this work has focused on the development of hardware to detect and measure

geophysical properties that are related to the discontinuity. In particular, Sandia has done developmental work on a borehole seismic system (BSS), a surface electrical potential system (SEP), and a controlled-source audio magnetotelluric technique (CSAMT). These tools have been demonstrated in full-scale field experiments including massive hydraulic fracturing, in situ coal gasification, coal mine fires, steam flood, fire floods, and in situ oil shale retorting. Moreover, the tools can, in fact, produce signals that can be used to infer some aspects of the geometry of the discontinuity associated with the process front. This summary presents some results from two of these techniques and then addresses the problem of the real-time implementation of the individual subsystems and the integration of these subsystems into a complete, computer-linked instrumentation system.

8430 **(EUR—11108-FR) Optimum planning and winning operations based on the interpretation of geological data.** Dreesen, R.; Liegeois, R. (Commission of the European Communities, Luxembourg). 1987. 53p. (In French). European Community Information Service, 2100 M St., NW, Suite 707, Washington, DC 20037.

After collecting, selecting, processing and interpreting large amounts of geological data from colliery archives, the possibilities and application limits have been investigated of forecasting sedimentary or structural hazards for a particular coal seam in exploitation. This has been applied to a few working panels located in a non-explored or badly known area within coal seams 56/57 and 55 (Zone of Genk, top of Westphalian A), in the eastern part of the Beringen Colliery and the adjacent area, of the Zolder Colliery (Campine Basin, north of the Brabant Massif). About 1,500 selected data have been processed into figurative maps on a 1/2 500 scale, showing the lateral evolution of the coal seam composition. More than 600 data points related to seam 56/57 have been processed into isopach maps. The various isopach maps (representing the thickness evolution of the selected parameters) were used to delimit danger zones (sand wedges, splits), as well as areas of less good quality (higher frequency of dirt bands) and zones of better composition for the studied coal seam. Lithostratigraphical fence diagrams have been realized by correlating lithostratigraphical data extracted from various sources (lithological descriptions of stonedrifts, blind shafts, surface and underground cored borings). These fence diagrams allow a quick estimation of the evolution in time and space, of a series of coal seams and associated sedimentary rocks over a relatively large area (several tens of square kilometres). Moreover, a sedimentological approach of the lithostratigraphical information allowed the lateral tracing of particular sandstone bodies and to assess their bearing on the surrounding coal seams and sediments. Finally, a frequency analysis of the smaller faults in the studied area revealed a positive relationship between transversal faulting and the presence of important dirt bands in a particular coal seam (compactional deformation rather than true tectonics).

0130 Transport And Handling

REFER ALSO TO CITATION(S) 8375

8431 **(CISE—3483) Characterization of the abrasion resistance of ceramic materials.** Martinella, R.; Fialdini, L.; Giovanardi, S.; Demichele, G.; Sbrana, L. (Centro Informazioni Studi Esperienze, Milan (Italy)). 1986. 24p. (In Italian). (ETN—87-90254; CONF-8609363—). NTIS, PC A02/MF A01.

From Conference on Giornate di Studio sulle Tribologia; La Casaccia, Italy (25 Sep 1986).

Ceramic materials were tested to improve the wear resistance of coal slurry systems in power stations, particularly the abrasion of the nozzle and other critical parts. Results show superiority of ceramic materials over metallic alloys. Within ceramics, the relative wear life in decreasing order is diamond, CSI, Al_2O_3, WC, and Si_3N_4.

0140 Combustion

REFER ALSO TO CITATION(S) 8388, 8419, 8426

8432 **(CONF-870659—7) Measurement of alkali vapors in PFBC [pressurized fluidized-bed combustion] process stream and their removal with a fixed granular-bed sorber, October 1, 1986-September 30, 1987.** Lee, S.H.D.; Myles, K.M. (Argonne National Lab., IL (USA)). 1987. Contract W-31109-ENG-38. 14p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88003061/JAW.

From 7. annual gasification systems conference; Morgantown, WV, USA (16 Jun 1987).

A fixed granular-bed sorber is being developed at Argonne National Laboratory (ANL) for the control of the alkali vapor in a PFBC process stream. To achieve the objectives of this project, a high temperature, high-pressure alkali sorber has been designed, fabricated, and installed onto the ANL laboratory-scale 15.2-cm-dia (6-in.-dia) pressurized fluidized-bed combustion (PFBC) facility (PFBC/alkali sorber facility). The real-time alkali concentrations (sodium and potassium) in the process stream are measured by an Ames on-line alkali analyzer for both the sorber-inlet and sorbed-outlet gas streams. In addition to the Ames alkali analyzer, a batch-type alkali and particulate sampling train (APST) is installed as a back-up for the analysis of both alkali vapor and particulate in the sorber-inlet gas stream. The APST is designed on the basis of a cold-trap condensation method. Three experimental activities have been proceeding during this year: (1) laboratory calibration of the Ames alkali analyzer and the batch-type APST, (2) laboratory study on alkali-vapor capture by stainless steel, and (3) modification of the PFBC/alkali sorber to reduce particulate loading in the PFBC process stream. Results of each activity are presented in this report.

8433 **(CONF-871041—4) Metal wastage in fluidized-bed combustors.** Berry, G.F.; Podolski, W.F.; Reimann, K.J.; Lyczkowski, R.W.; Youngdahl, C.A. (Argonne National Lab., IL (USA)). 1987. Contract W-31109-ENG-38. 16p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88003049/JAW.

From Advanced research and technology development direct utilization; Morgantown, WV, USA (13 Oct 1987).

Objectives of the research are (1) to develop guidelines for the design and operation of fluidized-bed combustion (FBC) units with minimum metal wastage rates and (2) to develop continuous erosion monitors for use in pilot plant and full-scale FBC units. The design guidelines will be developed from the understanding gained from the experimental studies and analytical model development activities. The computational models are being developed in order to predict the rates of metal wastage for specific FBC designs and operating conditions. 14 refs., 6 figs.

8434 **(DOE/PC/70815—T12) Kinetics of coal combustion: Ninth quarterly report.** Gat, N.; Petach, M.; Wolff, M.; Gavalas, G.R.; Flagan, R.C.; Essenhigh, R.H. (TRW Space and Technology Group, Redondo Beach, CA (USA); California Inst. of Tech., Pasadena (USA); Ohio State Univ., Columbus (USA)). Oct 1987. Contract AC22-84PC70815. 52p. (TRW-SN—44617-10/87). NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE88002335/JAW.

Individual abstracts are processed separately for the database. (CBS)

8435 **(DOE/PC/70815—T12, pp 3-18) Kinetics of volatiles combustion.** (TRW Space and Technology Group, Redondo Beach, CA). Oct 1987. NTIS, PC A04/MF A01. Order Number DE88002335/JAW. (TRW-SN—44617-10/87).

In Kinetics of coal combustion: Ninth quarterly report.

The "mixing rule" has been tested using published hydrogen/propane mixture combustion data. Results show a good correlation between the observed data and the predictions made by the "mixing rule." Stability loop data for coal volatiles is also reported. An attempt will be made to correlate the coal volatiles data with the kinetics derived for the "mixing rule." 15 refs., 18 figs., 6 tabs.

8436 (DOE/PC/70815—T12, pp 19-25) **Mechanisms and kinetics of coal volatiles combustion.** Essenhigh, R.H.; Shaw, D.W. (Ohio State Univ., Columbus). Oct 1987. NTIS, PC A04/MF A01. Order Number DE88002335/JAW. (TRW-SN—44617-10/87).

In Kinetics of coal combustion: Ninth quarterly report.

The objectives of this project are to develop a method of determining the operational or 'global' kinetics of combustion of volatiles from heated coal, and to compare the reaction rates (kinetic constants) for different coals to establish whether the kinetic behavior is rank sensitive or rank insensitive. The data are important for modeling the burning behavior of the volatiles. 6 refs., 3 figs., 1 tab.

8437 (DOE/PC/70815—T12, pp 26-37) **Engineering kinetics of char combustion.** Essenhigh, R.H. (TRW Space and Technology Group, Redondo Beach, CA). Oct 1987. NTIS, PC A04/MF A01. Order Number DE88002335/JAW. (TRW-SN—44617-10/87).

In Kinetics of coal combustion: Ninth quarterly report.

The objective was to develop a char rate equation (submodel) that is sufficiently elementary that it is tractable in complex flame models, but that is sufficiently complete that it incorporates such necessary and sufficient elements of the chemistry and physics involved in the char combustion (such as boundary layer diffusion, internal reaction, adsorption, and desorption of the reacting species) that combustion rates in flames can be calculated in flame models with required accuracy. 13 refs.

8438 (DOE/PC/70815—T12, pp 38-49) **Heterogeneous kinetics of char combustion.** Gavalas, G.R.; Flagan, R.C. (California Institute of Technology, Pasadena). Oct 1987. NTIS, PC A04/MF A01. Order Number DE88002335/JAW. (TRW-SN—44617-10/87).

In Kinetics of coal combustion: Ninth quarterly report.

The objective of this project is to obtain chemical kinetic data and to physically characterize chars from PSOC 1451 (bituminous-hvab) and PSOC 1443 (lignite) coals. 6 refs., 7 figs., 1 tab.

8439 **(EUR—10885-FR) Coal combustion with superheated blast in a plasma medium.** (Centre de Recherches Metallurgiques, Liege (Belgium)). 1987. 76p. (In French). Centre de Recherches Metallurgiques, Liege, Belgium.

Combustion trials with different types of coal were realized under physical thermal and chemical conditions similar to those existing at the blast-furnace raceway, in order to study the effects of the blast conditioning and the presence of a plasma medium in the vicinity of the coal injection. Extended experimental conditions were used, namely: temperatures of the combustion air comprised between 1100 and 1 700 C; oxygen enrichment of the combustion air up to 25%; coal types with volatiles comprised between 11 and 38%, with an ash content between 3 and 14%, with grain sizes between 20 and 98% minus 71μm; the possible presence of a plasma medium. The results obtained showed that: The coal combustion proceeds in three steps. During the first step, the coal is pyrolyzed and the volatiles released are burnt. The second step consists in the combustion of the residual char with oxygen. The third step corresponds to the char oxidation with the CO_2 and H_2O of the fumes; this reaction is very slow. The coal characteristics and especially its hydrogen and oxygen contents have a drastic effect on the coal pyrolysis and consequently on the yield of total gasified carbon. The coal grain size is another important factor for the overall combustion kinetics. The temperature and the oxygen content of the combustion air have equivalent effects. In the frame of this work, an increase of one or the other of these factors improves the carbon gasification of coals with relatively low H and O content. The presence of a plasma in the vicinity of the coal jet increases the coal gasification, all other factors being constant.

8440 **(UCRL—97569) Tubing wastage in fluidized-bed coal combustors: Examinations of tubing from Test Series 2, NCB (IEA Grimethorpe) Ltd. Facility.** Witherell, C.E.; Meisenheimer, R.G. (Lawrence Livermore National Lab., CA (USA)). 30 Oct 1987. Contract W-7405-ENG-48. 58p. (CONF-871191—1). NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE88002668/JAW.

From Workshop on wastage of in-bed surfaces in fluidized-bed combustors; Argonne, IL, USA (2 Nov 1987).

This study of wasted heat-exchanger tubing from the Grimethorpe PFBC Facility was conducted to characterize affected fireside surfaces and identify the mechanism/s responsible. Examinations showed that the wasted surfaces are not typical of those produced by erosion alone, as oxide deposits are present on all surfaces. Continual exfoliation of the normally-protective oxide layer is probably responsible for a major portion of tubing wastage. There are also indications of direct metal loss occurring through a series of events wherein repeatd formation and exfoliation of surface oxides produce an irregular metal interface that is mechanically deformed during combustor operation. The cold-worked metal protrusions, or platelets, on the roughened surface readily fracture from the tubing wall and are lost into the bed. 27 refs., 23 figs., 3 tabs.

8441 **Modeling heat transfer in an experimental coal-fired furnace when CO/sub 2//O/sub 2/ mixtures replace air.** Berry, G.; Wolsky, A. New York, NY; American Society of Mechanical Engineers (1987). 14p. (CONF-861211—). American Society of Mechanical Engineers, 345 East 47 St., New York, NY 10017.

From American Society of Mechanical Engineers winter meeting; Anaheim, CA, USA (7 Dec 1986).

Technical Paper 86-WA/HT-51.

A modeling study was conducted by Argonne National Laboratory (ANL) to simulate the heat-transfer that results from burning coal in a mixture of CO/sub 2/ and O/sub 2/ rather than in air. A one-dimensional model was developed and used to simulate results for a coal-air burn and for burns using three different CO/sub 2/-to-O/sub 2/ ratios: 3.65:1, 2.42:1, and 2.23:1. These simulation results are compared with experimental results for the same four cases. The authors find that the ANL model effectively predicts heat transfer in a coal-air burn and in the three CO/sub 2//O/sub 2/ burns. Both the model predictions and the test observations also demonstrate that using as the oxidizer a CO/sub 2//O/sub 2/ mixture, in a ratio between 2.42:1, and 2.23:1, imitates the heat-transfer results of a conventional coal-air burn. These findings lend further credence to the feasibility of burning coal in CO/sub 2//O/sub 2/ rather than air, a new concept being investigated by ANL. One principal motivation for the investigation is to find a way of suppressing harmful combustion effluents. Another is to determine the feasibility of recycling part of the combustion products (CO/sub 2/, principally) back to the combustion process and also of recovering saleable CO/sub 2/).

8442 **Computer simulation of pulverized coal combustion in various CO/sub 2//O/sub 2/ atmospheres and in air.** Berry, G.F.; Wang, C.S.; Chang, K.C.; Wolsky, A.M. New York, NY; American Society of Mechanical Engineers (1987). 8p. (CONF-861211—). American Society of Mechanical Engineers, 345 East 47 St., New York, NY 10017.

From American Society of Mechanical Engineers winter meeting; Anaheim, CA, USA (7 Dec 1986).

Technical Paper 86-WA/FACT-2.

In this study, the authors used a one-dimensional coal combustion or gasification (1-DICOG) computer code to simulate differences in the combustion performance of pulverized coal when various CO/sub 2//O/sub 2/ mixtures were substituted for air in the combustion process. Four test cases were analyzed, and results predicted by the model were compared with the corresponding results of actual combustion experiments. Comparisons of predicted and measured data for all test cases show that the observed trends of distributions of temperature and of species concentrations are predictable; discrepancies between predictions and measurements of these data are primarily attributed to limitations of the 1-DICOG computer code. The authors find that the combustion processes of pulverized coal can be completed in an atmosphere of CO/sub 2/ and O/sub 2/ over a range of Co/sub 2/-to-O/sub 2/ mole ratios between 2.23:1 and 3.65:1 – and that the combustion performance of coal burned in a CO/sub 2//O/sub 2/ atmosphere with a 2.42:1 mole ratio closely resembles that of coal burned in air.

0150 Marketing And Economics

REFER ALSO TO CITATION(S) 8962

0160 Health And Safety

8443 **(LA—10850-Vol.2) Kosova coal gasification plant health effects study: Volume 2, Industrial hygiene.** Brandt, M.T.; Jackson, J.O.; Sutcliffe, C.R.; White, O. Jr.; Premuzic, E.T.; Morris, S.C.; Haxhiu, M.A.; Abazi, A.; Jockic, M.; Jonuzi, B. (Los Alamos National Lab., NM (USA)). Oct 1987. Contract W-7405-ENG-36. 150p. NTIS, PC A07/MF A01; 1; GPO Dep. Order Number DE87008409/JAW.

The occupational health study performed in Obilich, Kosova, Yugoslavia, evaluated the potential health impact of the operation of a commercial-scale coal gasification facility on the workers and on public health. The effect of exposures to various chemical agents in the working environment generated in the coal gasification process was studied in exposed and control worker populations. A detailed assessment of certain workplaces in the generator plant, Phenosolvan plant, and Rectisol plant has been made. The procedures used in performing this study are applicable to studies in any population exposed to a variety of contaminants. Industrial hygiene studies have been performed concurrently with retrospective epidemiological investigations to permit investigators to establish a cause-effect relationship between the presence of chemical substances and health impairments, if such effects should be observed. A questionnaire about occupational exposure to contaminants was administered, taking into account each workplace in the examined population. Epidemiological investigations were directed at determining the incidence of changes in various organs and systems in exposed workers. 47 refs., 12 figs., 63 tabs.

0170 Legislation And Regulations

REFER ALSO TO CITATION(S) 8403

02 PETROLEUM

0202 Geology And Exploration

REFER ALSO TO CITATION(S) 9975

8444 **(UCRL—97537) Nuclear modeling techniques and nuclear data.** Soran, P.D. (Lawrence Livermore National Lab., CA (USA)). 16 Oct 1987. Contract W-7405-ENG-48. 6p. (CONF-871006—14). NTIS, PC A02. Order Number DE88002575/JAW.

From Nuclear science symposium; San Francisco, CA, USA (21 Oct 1987).

The current state-of-particle transport computer codes and associated nuclear data bases permit the accurate simulation of downhole sensor packages. Mathematical modeling can minimize design and experiment time, as well as provide new information on sensor design, environmental effects, and interpretation questions. Monte Carlo techniques can provide energy, time, and spatial information to permit signal partitioning and sensitivity analysis in complex geometries and environments. 49 refs., 3 figs., 3 tabs.

8445 **Model of hydrocarbon generation from Type I kerogen: application to Uinta basin, Utah.** Sweeney, J.J.; Burnham, A.K.; Braun, R.L. (Lawrence Livermore National Lab., CA). *AAPG Bulletin;* 71: No. 8, 967-985(Aug 1987). Contract W-7405-ENG-48.

The authors have developed a computer model that can predict when and how much oil and gas are generated from a source rock during its burial and later uplift. Kinetic parameters for the oil and gas generation reactions are obtained from high-pressure pyrolysis experiments carried out over a wide range of heating rates and temperatures. In their kinetic model, which applies only to Green River shale, they use a single activation energy of 52.4 kcal/mole and different pre-exponential factors for different products of primary pyrolysis, which allows them to extrapolate laboratory-derived kinetics to geologic heating rates. This model is in contrast to the wide distributions of activation energies or artificially low apparent activation energies used in some models of petroleum formation. When extrapolated to geologic heating rates on the order of 10°C/m.y., their kinetics show that the temperature of the maximum rate of oil generation (T/sub p/) changes by about 15°C when the heating rate is changed by an order of magnitude. Changes in pressure have relatively minor effects on the kinetics of oil generation but are important for gas generation reactions. They used geophysical data from oil fields in the Uinta basin of Utah to develop a thermal history model of Green River Formation source rocks. This time-temperature history was used to predict the maturation level of the kerogen at a given depth and to predict changes in the compositional characteristics of the oil. The shape of calculated oil generation rate curves, as a function of depth in the basin, mimics the shape of the overpressure curves; this similarity suggests that oil-gas generation may be an important cause of overpressuring. Maturation levels and compositional characteristics of the oil predicted by their model agree very well with characteristics of the oil recovered from the basin. 18 figures, 6 tables.

0203 Drilling And Production

REFER ALSO TO CITATION(S) 8429, 8467

8446 **(DOE/BC—87/2/SP, pp 25.4-25.28) Remote monitoring of the steam-flood enhanced oil recovery process.** Laine, E.F. (Lawrence Livermore National Lab., CA). Jul 1987. NTIS, PC A13/MF A01. Order Number DE87001217/JAW. Contract W-7405-ENG-48.

In Supporting technology for enhanced oil recovery: Third ammendment and extension to Annex IV enhanced oil recovery thermal processes.

Cross-borehole seismic velocity and high frequency electromagnetic attenuation data were obtained to construct tomographic images of heavy oil sands in a steam flood environment. First arrival seismic data were used to construct a tomographic color image of a 10 meter by 8 meter vertical plane. Two high frequency (17 and 15 megahertz) electromagnetic transmission tomographs were constructed of a 20 by 8 meter vertical planes. The velocity tomograph clearly shows a shale layer with oil sands on both sides. The EM tomographs show a more complex geology of oil sands with shale inclusions. The deepest EM tomograph shows the upper part of an active steam zone and indicates steam channeling just below the shale layer. The results show detailed structure of the entire plane between boreholes and may provide a better means to understand the in-situ heavy oil recovery steam flood process.

8447 **(DOE/BC—87/2/SP, pp 26.2-26.27) Acoustic signal thermal front tracking test in the M-6 Field.** Chacin, O. Jul 1987. NTIS, PC A13/MF A01. Order Number DE87001217/JAW.

In Supporting technology for enhanced oil recovery: Third ammendment and extension to Annex IV enhanced oil recovery thermal processes.

Thermal recovery projects in low to medium gravity oil reservoirs require a continuous control of the fluids spatial movements within the injection patterns in order to properly evaluate the process. Unfortunately, tools for in situ monitoring of actual flow distribution, movement rate and spatial heterogeneities of fire and steam fronts are still limited. Recently, high resolution geophysical methods have been introduced to assist in the related reservoir evaluation. Using one of these geophysical methods, INTEVEP conducted a feasibility study in the M-6 steam drive project, in order to verify changes in seismic properties of a thermal developed reservoir. In this study, petrophysical analysis done with M-6 core samples showed that fairly large velocity and attenuation anomalies are related with steam injection, which suggested that the steam zone could be seismically located. However, results of a first cross-well seismic field test with actual production wells were discouraging due to downhole sparker failure. The acoustic source could not generate enough output energy to overcome the adverse conditions found within the selected injection pattern (cased wells, unconsolidated sands, wells distance and receiver-well noise). Planning of future field tests in large scale steam projects, such as M-6, should

include more rigorous acoustic and electrical control of the downhole sparker or alternately consider other non-destructive seismic sources such as a downhole vibrator. Additionally, lower resolution seismic techniques (VSP and surface seismic) which do not present downhole source restrictions should be included in a more integrated feasibility study of EOR thermal front tracking projects.

8448 (DOE/BC—87/2/SP, pp 28.3) **Study of heat transfer of steam displacement.** Wang, F.; Brigham, W.E. Jul 1987. NTIS, PC A13/MF A01. Order Number DE87001217/JAW.

In Supporting technology for enhanced oil recovery: Third ammendment and extension to Annex IV enhanced oil recovery thermal processes.

A system of differential equations describing the temperature distribution in the insulation and the heat frontal movement in a cylindrical core during steam injection is derived and solved in Laplace space. The real-time solution is obtained by using the Stehfest algorithm. The solution shows that movement of the heat front is strongly dependent on the heat transfer coefficients at the inner and outer boundaries. Experimental results of steam injection are shown at pressures varying from 0.11-1.42 MPa (16 to 206 psia). The apparent thermal conductivity of the insulation as a function of temperature was obtained by comparing experimental data with an analytic solution. A method for approximation the steam swept volume is presented using an adjustment to the Marx and Langenheim equation and a new definition of the critical time. This method improves the approximation of the steam swept volume. The steam mobility can be reduced by alternate injection of steam and surfactant slugs. The steam mobility decreased with an increase of surfactant concentration and with an increase in the slug sizes of the surfactant solutions. The addition of nitrogen in the injected steam further reduced the steam mobility, with very little effect seen at concentrations of nitrogen above about one mole percent.

8449 (DOE/BC—87/2/SP, pp 28.4-28.7) **Laboratory study of surfactants as foam diverting agents.** Jul 1987. NTIS, PC A13/MF A01. Order Number DE87001217/JAW.

In Supporting technology for enhanced oil recovery: Third ammendment and extension to Annex IV enhanced oil recovery thermal processes.

An insulated cylindrical core packed with unconsolidated sand was used to study and compare commercially manufactured surfactants. Each surfactant was injected with steam and nitrogen simultaneously to generate a foam in-situ. The diverting capability of the foam was measured in terms of pressure drops along the cylindrical core. The surfactants that will be studied in this experience are Chevron's SD1000 and Shell's Endoret AOS 1618.

8450 (DOE/BC—87/2/SP, pp 28.8-28.9) **Two-dimensional displacement of oil by gas and surfactant under foaming conditions.** Mahmood, S.M.; Brigham, W.E. Jul 1987. NTIS, PC A13/MF A01. Order Number DE87001217/JAW.

In Supporting technology for enhanced oil recovery: Third ammendment and extension to Annex IV enhanced oil recovery thermal processes.

A number of conclusions, both qualitative and quantitative have been arrived at as a result of this research. In this two-dimensional sandpack, gravity was always an important force for all injection rates. The rates used were in the range that would scale to the rates of typical oil field reservoirs. In all cases it was found that gas rose to the top of the sandpack and rapidly formed a thin Dietz-type tongue extending up to the producing end. The rate of gas injection had virtually no effect on the behavior of this gas finger. The qualitative conclusions are somewhat speculative in nature and thus lead to the recommendations for further research to better define the general nature of foam flow behavior when gravity force is also important.

8451 (DOE/BC—87/2/SP, pp 28.10-28.13) **Foam/emulsion displacement of oil in unconsolidated sandpacks.** Jul 1987. NTIS, PC A13/MF A01. Order Number DE87001217/JAW.

In Supporting technology for enhanced oil recovery: Third ammendment and extension to Annex IV enhanced oil recovery thermal processes.

The aim of this research is to try and separate the different effects that a gas driven surfactant slug has on oil recovery. Three chemically similar surfactants whose properties range from foaming agents to emulsifying agents are being used to separate the effects of wettability changes and reduced oil-water interfacial tension from the other effects that a foam phase has an oil displacing aid. The early results from the runs where the polymer was included in the surfactant slug indicate that the polymer slows down the rate of oil recovery initially, but produces the oil at a more even rate and results in higher ultimate recovery. Another effect of the addition of the polymer to the surfactant solution was a dramatic decrease in the aqueous phase recovery. In each instance, the addition of polymer reduced the aqueous phase recovery to about 10% of its value when no polymer was added.

8452 (DOE/BC—87/2/SP, pp 28.14-28.17) **Flow of foam through micromodels.** Jul 1987. NTIS, PC A13/MF A01. Order Number DE87001217/JAW.

In Supporting technology for enhanced oil recovery: Third ammendment and extension to Annex IV enhanced oil recovery thermal processes.

This work started in the summer of 1986. The objective is to study the flow of foam through a micromodel as an extension of the work done by Owete and Brigham (1984). In his research, Owete used etched silicon wafers to represent a monolayer of porous matrix. He used two types of models, one with homogeneous pore structures and one with randomly distributed pore structures. In his experiments, Owete injected air into the surfactant saturated models and observed the flow characteristics of foam under varying air injection rates, pore dimensions and surfactant concentration. However, he never introduced oil in his models. The authors are attempting to observe the more complex behavior of flow of foam with oil. This work involves the same procedure as Owete's with a few exceptions. Instead of using etched silicon wafers, a single layer of sand is used as the porous medium. Instead of injecting air, CO_2 is injected to reduce the amount of residual gas in the micromodel. The runs are made at room temperature and atmospheric pressure. Under these conditions, CO_2 is immiscible. Surfactant followed by CO_2 is injected into the model which had previously been saturated with oil. Observations were made of the foam flow mechanisms under varying injection rates and surfactant concentration.

8453 (DOE/BC—87/2/SP, pp 28.18-28.38) **Transient behavior of surfactant foam flow in porous media.** Jul 1987. NTIS, PC A13/MF A01. Order Number DE87001217/JAW.

In Supporting technology for enhanced oil recovery: Third ammendment and extension to Annex IV enhanced oil recovery thermal processes.

One promising method to improve a steam drive is by the formation of an in-situ foam. This is accomplished by injecting a small amount of a surfactant along with the steam. Sometimes also, a noncondensible gas such as nitrogen is mixed in. Foam's high apparent viscosity could greatly improve the mobility ratio, and the blocking ability of foam is useful in reducing the thieving effect of high permeability streaks on premature steam breakthrough. As reported by Lescure and Claridge, these beneficial characteristics could also be utilized to improve the efficiency of other enhanced recovery methods, namely carbon dioxide flooding.

8454 (DOE/BC—87/2/SP, pp 28.39-28.75) **Apparent viscosity measurements of surfactant foam in porous media.** Treinen, R.J.; Brigham, W.E.; Castanier, L.M. Jul 1987. NTIS, PC A13/MF A01. Order Number DE87001217/JAW.

In Supporting technology for enhanced oil recovery: Third ammendment and extension to Annex IV enhanced oil recovery thermal processes.

The apparent viscosity of surfactant foam in a sand pack model was measured at reservoir flow velocities. The effects of foam quality, surfactant concentration, and flow rate were investigated. Ottawa sand, 120-140-mesh, was packed into a 1 by 24 inch

tube. Foam of a known quality and flow rate was continuously injected into the sand pack until a steady state condition was reached. Pressure drop was measured across three different segments of the sand pack. A system back pressure of 50 psig was applied to minimize changing foam quality caused by gas expansion. Results show that the apparent viscosity of surfactant foam ranges from 50 to 70 centipoise at reservoir flow velocities. Increasing the foam quality corresponded to a small increase in the apparent viscosity of foam. Changes in surfactant concentration from 0.005 to 0.05 wt% caused a rapid increase in apparent viscosity. Changes in concentration above 0.05 wt% had little effect on apparent viscosity. Increasing the flow rate resulted in a reduction of the apparent viscosity of foam. This pseudo-plastic flow behavior has been widely reported in the literature. The apparent viscosity of foam in porous media was significantly effected by flow rate history.

8455 (DOE/BC—87/2/SP, pp 28.76-28.94) **Foams in porous media a literature survey.** Marsden, S.S. Jul 1987. NTIS, PC A13/MF A01. Order Number DE87001217/JAW.

In Supporting technology for enhanced oil recovery: Third ammendment and extension to Annex IV enhanced oil recovery thermal processes.

Since a lot of research on foam in porous media has been done on the SUPRI project and a great deal of new information has appeared in the literature, the authors believed that a new, up-to-date search should be done on foam alone, one which would be helpful to students and perhaps of interest to others. This has been based on references which were known to the author and supplemented by those in the MS Research Report of Bret Beckner and the drafts of the PhD dissertations of Syed Mahmood and Fred Wang. However, the interpretation and presentation of the material is the sole responsibility of the author.

8456 (DOE/BC—87/2/SP, pp 29.2-29.49) **Determination of steam - water relative permeabilities from experimentally observed pressure profiles.** Ziritt, J.L.; Paz, F.; Barboza, M.E.; Monsalve, A. Jul 1987. NTIS, PC A13/MF A01. Order Number DE87001217/JAW.

In Supporting technology for enhanced oil recovery: Third ammendment and extension to Annex IV enhanced oil recovery thermal processes.

Task 29 under the present Annex IV Agreement, calls for INTEVEP to supply DOE with information on research performed leading to a field test on steam with additives in Venezuela. Venezuela's latest experience on the use of additives with steam is a field test performed in cyclic steam injection wells in the Bolivar Coast. Details of the field test were presented on the SPE Enhanced Oil Recovery Symposium held at Tulsa, Oklahoma on April, 1986. At present, INTEVEP's research effort has been addressed to evaluate the influence of the additives on the performance of the field test. Hereafter follows a summarizing report containing the description of a mathematical model used to simulate steam-water steady state flow through porous media. This model has been used to interpret experimental data in order to evaluate the influence of a surfactant on the steam-water relative permeability curves.

8457 (DOE/BC—87/2/SP, pp 30.1-30.31.1) **Thermal EOR process research and development.** Aeschliman, D.P.; Markwell, D.L. (Sandia National Labs., Albuquerque, NM). Jul 1987. NTIS, PC A13/MF A01. Order Number DE87001217/JAW.

In Supporting technology for enhanced oil recovery: Third ammendment and extension to Annex IV enhanced oil recovery thermal processes.

One particularly critical aspect of EOR technology is process control. Production rates, injection rates, and the location and number of wells can be used to control the migration of fluids in the reservoir and thereby influence the amount of oil ultimately recovered. Moreover, monitoring the geometry of fluid migration patterns and inferring the shape and velocity of the constitutive zones of an EOR process is central to process control and is, therefore, essential to optimize production. To date three experiments have been performed in PESL that relate to thermal EOR process-dependent reservoir electrical properties. The first was conducted in December of 1984 and represented a demonstration of most of the PESL subsystems. Low-pressure (100 psig) steam of undetermined quality was used to displace heavy (13 degree API) crude from an uncharacterized sandpack (core pressure measurement capability was not available at that time). Results of the first test were summarized briefly. Since then, a number of important changes have been made to PESL, and two tests have been conducted. The first of these was a steam displacement of brine. The second, was a steam displacement of heavy oil and brine, and was designed to simulate, as closely as possible, heavy oil recovery using steam drive in a California heavy oil reservoir. Specifically, the test simulated a steam flood in the Tulare D sand at a depth of about 700 ft (210 m) in the South Belridge field, under development by Shell California Production Inc. near Bakersfield.

8458 (DOE/BC—87/2/SP, pp 31.2-31.32) **Research program on heavy oil recovery by CO_2.** de Pedroza, T.M.; Escobar, E.; Rivas, O. Jul 1987. NTIS, PC A13/MF A01. Order Number DE87001217/JAW.

In Supporting technology for enhanced oil recovery: Third ammendment and extension to Annex IV enhanced oil recovery thermal processes.

This report summarizes the results of an experimental program to evaluate heavy oil recovery by CO_2 injection. A 10° API oil from the Venezuelan Boscan field was selected for the study. Thermodynamic and rheological studies were performed for CO_2/heavy oil systems. Displacement experiments inside the porous medium, were also performed at reservoir conditions. Results indicate that the flow behavior of the fluids is Newtonian and that CO_2 solubility produces a high swelling of the crude and appreciably reduces the viscosity and interfacial tension of the oil. Continuous CO_2 displacement in porous media showed rapid CO_2 channelling while CO_2 water alternating gas schemes gave higher displacement efficiencies.

8459 (DOE/BC/10842—5, pp 7-30) **Microemulsions and their precursors.** Oct 1987. NTIS, PC A11/MF A01. Order Number DE87001260/JAW.

In Flow in porous media, phase behavior and ultralow interfacial tensions: Mechanisms of enhanced petroleum recovery: First annual report, October 1, 1985-September 30, 1986.

One of the goals of the research program at the University of Minnesota is to understand the relationship between molecular structure, fluid compositions and the properties of microemulsions. A logical step toward attaining this goal is to distinguish solutions of brine, hydrocarbon and mere amphiphile from microemulsions of brine, hydrocarbon and surfactant. To this end the researchers have been carrying out a systematic study of the microstructure of a sequence of solutions of straight-chained ethoxylated alcohols with hydrocarbon and brine. The sequence begins with propanol and includes H(CH$_3$)/sub n/ (OCH$_2$CH$_3$)/sub m/OH (denoted as C/sub n/E/sub m/) with n ranging from 3 to 12 and m from 0 to 7. A concerted effort was made to investigate the low end of this sequence to try to capture the pre-surfactant trends and pre-microemulsion patterns of amphiphiles that do not qualify as surfactants. The work is complementary to the extensive studies of microemulsions of C/sub n/E/sub m/ carried out by Kahlweit and coworkers, Lindman and coworkers, and Shinoda and coworkers. The status is reported of the studies of C_8E_6, C_4E_0, C_4E_1 and C_6E_8 - hydrocarbon-brine systems. Before giving these results, however, the paper presents the established behavior of microemulsions. 57 references, 16 figures, 7 tables.

8460 (DOE/BC/10842—5, pp 31-72) **Controlled environment vitrification system: electron microscopy of surfactant systems.** Oct 1987. NTIS, PC A11/MF A01. Order Number DE87001260/JAW.

In Flow in porous media, phase behavior and ultralow interfacial tensions: Mechanisms of enhanced petroleum recovery: First annual report, October 1, 1985-September 30, 1986.

Cryofixation of liquid samples for electron microscopy is facilitated by the Controlled Environment Vitrification System (CEVS). The CEVS permits cryofixation of hydrated biological and colloidal dispersions and aggregates from a temperature and saturation controlled environment. Specimens prepared in uncontrolled laboratory atmosphere are subject to evaporation and temperature fluctuations that may introduce artifacts due to concentra-

tion, pH, ionic strength and temperature changes. Moreover, it is difficult to examine microstructure of systems when conditions of interest are at temperatures other than ambient (e.g. biological systems at in-vivo temperatures). The system described here ensures that a liquid or partially liquid specimen is maintained in its original state while it is being prepared prior to vitrification, and once prepared, vitrified with minimal alteration of its microstructure. A controlled environment is provided within a chamber where temperature and chemical activity of volatile components can be precisely controlled while the specimen is being prepared. The specimen is mounted on a plunger, and a synchronous shutter is opened almost simultaneously with the release of the plunger, so the specimen is propelled abruptly through the shutter opening into a cryogenic bath. The paper describes the system and its use, and illustrates the importance of the technique with TEM examples of vesicles and liposomes of surfactants where artifacts were avoided by using the CEVS. The paper also discusses applications to other techniques like SEM and freeze-fracture, and to novel on the grid experiments that make it possible to freeze successive instants of dynamical processes such as membrane fusion, chemical reactions, and phase transitions. 22 references, 28 figures.

8461 (DOE/BC/10842—5, pp 73-131) **Periodic surfaces of prescribed mean curvature.** Oct 1987. NTIS, PC A11/MF A01. Order Number DE87001260/JAW.

In Flow in porous media, phase behavior and ultralow interfacial tensions: Mechanisms of enhanced petroleum recovery: First annual report, October 1, 1985-September 30, 1986.

This research was stimulated by the need for mathematically well-characterized surfaces that divide space into two distinct, multiply-connected, intertwined subspaces - spatial structures that are called bicontinuous. In these, one of the subspaces is occupied by a solid that is more or less deformable and the other, though it may be referred to as void, is occupied by a fluid. If two distinct surfaces dividing hydrocarbon-rich from surfactant-rich and surfactant-rich from water-rich are envisioned, this microstructure could be considered tricontinuous. Certain equilibrium microemulsion phases that contain comparable amounts of hydrocarbon and water as well as amphiphilic surfactant may be chaotic bicontinuous (or tricontinuous) structures, maintained in a permanent state of fluctuating disorder by thermal motions. Here the research is concentrated on geometrically-ordered, bicontinuous structures. Some mathematical background and a brief historical review of the study of periodic minimal surfaces are provided. The computational methods are introduced for constructing a surface whose mean curvature is a prescribed function of position, and which meets a given body at a prescribed contact angle; elsewhere the method is generalized to curves of prescribed space curvature lying in a known surface. The paper presents five new families of triply-periodic surfaces of constant mean curvature and records the areas and volumes of unit cells as they track in mean curvature; surfaces with prescribed nonconstant, smoothly varying mean curvature are also computed. 70 references, 9 figures, 5 tables.

8462 (DOE/BC/10842—5, pp 132-150) **Equilibrium thin films on rough surfaces: two-phase transport in idealized pores.** Oct 1987. NTIS, PC A11/MF A01. Order Number DE87001260/JAW.

In Flow in porous media, phase behavior and ultralow interfacial tensions: Mechanisms of enhanced petroleum recovery: First annual report, October 1, 1985-September 30, 1986.

The structure and stability of perfectly wetting fluid menisci in axisymmetric pores have been investigated using the augmented Young-Laplace equation as solved by the Galerkin/finite-element method. Both continuous and disconnected menisci geometries have been considered. The results of these calculations for single and multiple pore microscopic systems have been applied to macroscopic systems by the application of a statistical theory of multiphase transport in porous media. The results indicate the existence of two transport mechanisms: a capillary jump mechanism by which the non-wetting fluid invades pores, and a film drainage mechanism by which wetting films and pendular structures, remaining after the invasion of the non-wetting fluid, continue to drain. The difference between the two mechanisms is apparent at low wetting phase saturating in both the predictions of the statistical theory and in displacement experiments of perfectly wetting and intermediately wetting fluids in sintered teflon synthetic porous media. 14 references, 18 figures.

8463 (DOE/BC/10842—5, pp 151-175) **Theory and computer simulation of structure, transport and flow of fluid in micropores.** Oct 1987. NTIS, PC A11/MF A01. Order Number DE87001260/JAW.

In Flow in porous media, phase behavior and ultralow interfacial tensions: Mechanisms of enhanced petroleum recovery: First annual report, October 1, 1985-September 30, 1986.

An overview is given of recent progress made on this topic. The density profiles of fluid in micropores are found by solving numerically an approximate Yvon-Born-Green equation. A related local average density model (LADM) allows prediction of transport and flow in inhomogeneous fluids from density profiles. A rigorous extension of the Enskog theory of transport is also outlined. Simple results of this general approach for the tracer diffusion and Couette flow between planar micropore walls are presented. Equilibrium and flow (molecular dynamics) simulations are compared with the theoretical predictions. Simulated density profiles of the micropore fluid exhibit substantial fluid layering. The number and sharpness of fluid layers depend sensitively on the pore width. The solvation force and the pore average density and diffusivity are oscillating functions of the pore width. The theoretical predictions for these quantities agree qualitatively with the simulation results. The flow simulations indicate that the flow does not affect the fluid structure and diffusivity even at extremely high shear rates ($10^{10}s^{-1}$). The fluid structure induces large deviations of the shear stress and the effective viscosity from the bulk fluid values. The flow velocity profiles are correlated with the density profiles and differ from those of a bulk fluid. The LADM and extended Enskog theory predictions for the velocity profiles and the pore average diffusivity agree very well with each other and with the simulation results. The LADM predictions for the shear stress and the effective viscosity agrees fairly well with the simulation results. 21 references, 10 figures, 2 tables.

8464 (DOE/BC/10842—5, pp 176-221) **Simulation of one-dimensional, two-phase, Darcy flow.** Oct 1987. NTIS, PC A11/MF A01. Order Number DE87001260/JAW.

In Flow in porous media, phase behavior and ultralow interfacial tensions: Mechanisms of enhanced petroleum recovery: First annual report, October 1, 1985-September 30, 1986.

In developing a two-dimensional, and subsequently a three-dimensional, two-phase flow simulator, it is logical to tackle the simpler one-dimensional case first. Using this relatively simple system as a foundation has several advantages. From the standpoint of computer programming, developing first a simpler algorithm and then building upon it is much easier than attempting a large problem at once and then having to spend weeks to exterminate the bugs. More importantly, analytical solutions of special cases of the one-dimensional case are more likely to be available than of any two-dimensional case. The best way of assessing a numerical routine's performance is to compare its results to the analytical solution, if one is available. Fortunately, in 1982 Fokas and Yortsos published a closed-form solution of a realistic one-dimensional, two-phase flow problem. The one-dimensional flow simulator developed here is tested by solving their problem for nine cases displaying a range of saturation front behavior. This paper presents the details of the numerical algorithm, the two-phase flow model and solution of Fokas and Yortsos, comparisons of simulated and analytical results, and CRAY-2 considerations, such as timing, vectorization, and multitasking of code. 15 references, 25 figures, 3 tables.

8465 **The application of hand-held computers in gathering field data.** Bettis, T.A.; Shreve, M.A. (Mitchell Energy Corp.). pp 39-46 of Proceedings of the 1987 SPE annual technical conference and exhibition: Production operations and engineering. Richardson, TX; Society of Petroleum Engineers (1987). (CONF-870913—).

From Annual technical conference and exhibition of the Society of Petroleum Engineers; Dallas, TX, USA (27 Sep 1987).

Technical Paper SPE 16876.

Recent developments in hand-held computer technology have made feasible the direct daily transfer of field data to a common, easily accessible data base. This ability to readily access current information benefits field operators, clerical workers, engineering staff and management by making information quickly available, while substantially reducing paperwork.

0204 Processing

REFER ALSO TO CITATION(S) 8393, 8407

0207 Marketing And Economics

REFER ALSO TO CITATION(S) 8960, 8961

0209 Environmental Aspects

REFER ALSO TO CITATION(S) 9919

8466 **(PB—88-103262/XAB) Prevention of pollution by oil (Civil Engineering Technical Guide).** (Property Services Agency, London (UK). Directorate of Civil Engineering Services). 1987. 66p. (CE-TECHNICAL GUIDE—41). NTIS, PC E06/MF E06.

This technical guide sets out the principles of oil/water separation and gives guidance on the selection of oil interceptors and separators. It also deals with pollution prevention procedures and methods, spillage, and leakage of oil products and clean-up procedures.

03 NATURAL GAS

0302 Geology And Exploration

REFER ALSO TO CITATION(S) 8444, 8445, 9975, 9980

0303 Drilling, Production, And Processing

REFER ALSO TO CITATION(S) 8465

0309 Artificial Stimulation

8467 **Self-powered pumps for watered-out trapped gas.** Elliott, G.R.B.; Yates, T.M.; Yates, D.; Mc Daniel, M.; Houseman, B.L.; Elliott, R.D. (Los Alamos Consultants). pp 47-54 of Proceedings of the 1987 SPE annual technical conference and exhibition: Production operations and engineering. Richardson, TX; Society of Petroleum Engineers (1987). (CONF-870913—).

From Annual technical conference and exhibition of the Society of Petroleum Engineers; Dallas, TX, USA (27 Sep 1987).

Technical Paper SPE 16878.

The high-pressure gas in underground reservoirs can be used to provide the energy to pump brine underground and away from a well, thereby preventing premature watering out of water-drive gas wells. Use of such work has been demonstrated with modified 5-in turbine pumps acting as motors in an above-ground 500-gallon system. Such pumping work can also be used in secondary recovery of petroleum and in recovery of dissolved or hydrated natural gas.

0340 Combustion

REFER ALSO TO CITATION(S) 9004

8468 **(PB—88-112479/XAB) Turbulent-flame characterization for improved gas-burner performance. Final report, November 1983-June 1986.** Kelly, J.; Namazian, M. (Acurex Corp., Mountain View, CA (USA)). Jun 1986. 69p. (ACUREX-FR—86-105-ESD). NTIS, PC A04/MF A01.

See also PB—85-180495.

Flame-diagnostic measurements were made on practical burner flames and on idealized bluff-body burner flames to identify flame characteristics to be used in improving burner designs. For the practical burner, flame-visualization studies were made with direct photography, short-exposure schlieren and high-speed schlieren movies for radial, coaxial, and bluff-fuel injector configurations with and without divergent quarls and combustion-air swirl. The coaxial and radial injector flames were stabilized away from the burner face and had small-scale inner flow structures on large-scale outer structures. The bluff-body flame was stabilized by the recirculation zone and showed smaller substructures in the non-jet region. For the idealized bluff-body burner, visualization was made by photographs of light scattered from laser-illuminated alumina seed particles, and concentration profiles were obtained with Raman scattering and laser-induced fluorescence. Flame visualization showed a wide variety of flame types resulting from varying air and fuel flow. With low air flow, flames were stabilized at the burner face by 3-D vortices. At high air flow, flames were stabilized by a stagnation zone on the burner axis. Both flames showed large-scale intermittent structures. Laser-concentration imaging was very effective in revealing flame initiation and propagation. At low air flow, flames propagate by periodic bursts of near burner vortices. At high air flow, diffusion flames are established in the vicinity of the stagnation zone.

04 OIL SHALES AND TAR SANDS

0401 Reserves And Exploration

REFER ALSO TO CITATION(S) 9975

0403 Drilling, Fracturing, And Mining

8469 **A technique for predicting fragmentation and fragment sizes resulting from rock blasting.** Kuszmaul, J.S. (Sandia National Labs., Albuquerque, NM). pp 893-900 of Rock mechanics: Proceedings of the 28th U.S. symposium. Farmer, I.W.; Daemen, J.J.K.; Desai, C.S.; Glass, C.E.; Neuman, S.P. Accord, MA; A.A. Balkema Publishers (1987). (CONF-870625—). Contract AC04-76DP00789.

From 28. U.S. symposium on rock mechanics; Tucson, AZ, USA (29 Jun 1987).

Rock fracturing models have previously been developed that provide good descriptions of fracturing induced by blasting, but they fail to differentiate between a flawed continuum and a discontinuous medium. A new description, which is based on three-dimensional percolation theory, is introduced to make this distinction. This new technique also provides a description of the size of the fragments above the new fragmentation threshold. These new formulas are used in a simulation of a single blastwell cratering experiment in oil shale. The simulation results show that the predicted discontinuous region is reasonably similar to the excavated crater obtained in the experiment.

0404 Oil Production, Recovery, And Refining

REFER ALSO TO CITATION(S) 8386, 8429, 8446

8470 **(UCRL—97352) Further comparison of methods for measuring kerogen pyrolysis rates and fitting kinetic parameters.** Burnham, A.K.; Braun, R.L.; Samoun, A. (Lawrence Livermore National Lab., CA (USA); Lab Instruments, Inc., Kenwood, CA (USA)). Sep 1987. Contract W-7405-ENG-48. 15p. (CONF-8709131—1). NTIS, PC A03/MF A01; GPO Dep. Order Number DE88000222/JAW.

From 13. international meeting on organic geochemistry; Venezia, Italy (21 Sep 1987).

We compare rates of product generation during pyrolysis of several petroleum source rocks and isolated kerogens by nonisothermal techniques, including Rock Eval pyrolysis, condensed oil evolution, and pyrolysis MS/MS. We discuss problems related to temperature calibration in the Rock Eval instrument, and confirm that standard Rock Eval temperatures are in error by about 40°C. Calculations using Gaussian and discrete activation energy distributions and associated frequency factors derived from Rock Eval data by nonlinear regression agree within a few °C with oil evolution at 2°C/min and pyrolysis-MS/MS at 4°C/min. This comparison also demonstrates that activation energy distributions are needed for oil alone as well as for gas and for total hydrocarbons from many

source rocks. Discrepancies between Rock Eval kinetics and oil evolution at 2°C/h and hydrous pyrolysis are related to mass transport limitations. We discuss the sensitivity of the extrapolation of reaction rates to geological conditions and how the extrapolation may be influenced by erroneous data or kinetic analysis. 12 refs., 5 figs., 3 tabs.

8471 Method for in situ heating of hydrocarbonaceous formations. Little, W.E.; Mc Lendon, T.R. (to Dept. of Energy, Washington, DC). US Patent 4,705,108. 10 Nov 1987. Filed date 27 May 1986. vp. Patent and Trademark Office, Box 9, Washington, DC 20232.

A method for extracting valuable constituents from underground hydrocarbonaceous deposits such as oil shale comprising the steps of: drilling a hole into but not beyond a stratum which contains a rich deposit of valuable constituents; hydraulically fracturing the stratum which contains the deposit to form a single horizontally extending fracture plane located at the bottom of the hole; injecting a liquid and conducting proppant into the fracture plane to form a horizontal liquid plate; introducing electrical excitations to the stratum adjacent the liquid plate; continuing the electrical excitation to retort the stratum along the liquid plate; and recovering valuable constituents from the stratum adjacent the liquid plate.

0405 Properties And Composition

8472 Strain rate dependent mechanical properties of Western oil shale. Chong, K.P.; Harkins, J.S.; Kuruppu, M.D.; Leskinen, A.I. (Dept. of Civil Engineering, Univ. of Wyoming, Laramie, WY). pp 157-164 of Rock mechanics: Proceedings of the 28th U.S. symposium. Farmer, I.W.; Daemen, J.J.K.; Desai, C.S.; Glass, C.E.; Neuman, S.P. Accord, MA; A.A. Balkema Publishers (1987). (CONF-870625—).

From 28. U.S. symposium on rock mechanics; Tucson, AZ, USA (29 Jun 1987).

The purpose of this paper is to determine the effect of strain rate on initial average Young's modulus and the Poisson's ratio for different grades of Colorado oil shale. Material anisotropy is considered. Cylindrical specimens cored in a particular orientation of the oil shale formation are tested both in tension and in compression, and the rate effects are investigated. The technique developed is quite general, applicable to different types of transversely isotropic rocks.

0410 Environmental Aspects

8473 Growth of bacteria in an oil shale retort water by indigenous microorganisms. Gauger, W.K.; Williams, S.E. (South Dakota State Univ., Brookings). *Bulletin of Environmental Contamination and Toxicology;* **38**: No. 5, 769-774(May 1987). Contract AS20-77LC01761.

Previous studies have shown that relatively high aerobic and anaerobic (or facultatively anaerobic) heterotrophic bacterial population densities occur as indicated by an increase in the turbidity of freshly filtered (0.4 μm) Omega-9 retort water after a few days incubation at room temperature. Growth of these microorganisms alters the nature and concentrations of dissolved organic and inorganic constituents. Bacteria are the only microorganisms known to have demonstrated a capacity to grow in undiluted Omega-9 retort water. Bacterial growth experiments are performed for a variety of reasons. In some situations microorganisms are cultivated to yield a specific product, as a protein source, or because their growth in a particular medium removes certain undesired constituents. Nutritional and physical parameters will often govern the rate at which growing microbial populations proliferate. It was considered important, therefore, to establish what rates of bacterial growth were occurring in the Omega-9 retort water by indigenous, mixed bacterial populations. The study reported here was devised to assess bacterial growth characteristics in an example retort water. Information of this type may have implications in 1) the development of biological treatment systems, 2) establishing hazard assessment and abatement criteria, and 3) in assessing the stability of research samples.

05 NUCLEAR FUELS

REFER ALSO TO CITATION(S) 9042

8474 (BMU—1987-146) Data on facilities and processes of the nuclear fuel cycle. Holzhauer, U.; Mester, W.; Mielke, H.G.; Ulenbruck, H. (Bundesministerium fuer Umwelt, Naturschutz und Reaktorsicherheit, Bonn (Germany, F.R.); Gesellschaft fuer Reaktorsicherheit m.b.H. (GRS), Koeln (Germany, F.R.)). 1987. 170p. (In German). (GRS-A—1259). GRM Werbeberatung - Werbemittlung - PR, Eggenstein-Leopoldshafen, Germany, F.R.

Schriftenreihe Reaktorsicherheit und Strahlenschutz. Ergebnisberichte, Untersuchungen, Studien, Gutachten.

This report compiles important data on domestic and foreign facilities and processes of the nuclear fuel cycle. The data refer to the status of January 1986 and include the following parts of the nuclear fuel cycle: Uranium enrichment, fuel fabrication, transportation casks for irradiated fuel elements, interim storage, fuel reprocessing, radioactive waste management, final disposal of radioactive wastes and irradiated fuel elements. A short survey of German facilities is given in the introductory chapter. This report does not claim to be complete but provides by means of its compressed representation a prompt overview on existing or planned installations of the nuclear fuel cycle.

8475 (EUR—10761) Evaluation of the Community's research programme "Nuclear measurements and reference materials" (1980-1985). Hansen, N.; Ache, H.J.; Brown, D.; Michaudon, A.; Yoccoz, J. (eds.). (Commission of the European Communities, Luxembourg). 1987. 117p. NTIS (US Sales Only), PC A06/MF A01. Order Number DE88751587/JAW.

A panel has evaluated the research programme "Nuclear measurements and reference materials" performed by JRC-Geel, CBNM (Central Bureau for Nuclear Measurements) during the period 1980-85. Furthermore the panel has considered more general topics such as major facilities, staff and collaboration between JRC-Geel, CBNM and other organizations. Finally, the panel has discussed the future direction of the programme. The panel expressed its satisfaction with the scientific and technical quality of the work and recommended that JRC-Geel, CBNM should continue to play an important role in Europe in the fields of nuclear measurements and nuclear reference materials. The panel also recommended that the underlying research be strengthened and that the nuclear experience and expertise of JRC-Geel, CBNM be utilized for non-nuclear applications.

0501 Reserves, Exploration, And Mining

REFER ALSO TO CITATION(S) 9975

0504 Feed Processing

8476 (CNIC—00016) Effect of various forms of silicic acid in uranium-containing solution on formation of stable emulsion in solvent extraction. Chen Yude; He Xiequn; Ren Shougong; Zhang Keping. (China Nuclear Information Centre, Beijing, BJ). 1986. 9p. (In Chinese). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88700753/JAW.

A stable emulsion easyly appears, if acid leached solution from silicate uranuim ore containing more fluorite is treated by solvent extraction process. The relationship between formation of stable emulsion and silicic acid forms in solvent extraction has been studied by chemical analysis and electron microscope. It shows that the active silicic acid, intermediate polymerized silicic acid and silica gel can not lead to stable emulsion formation. The silicic acids of emulsion-causing are high polysilicic acids. The forms of various silicic acids in solution determine either the stable emulsion appears or disappears. If microamount of fluorine is present in solution, it will accelerate the polymerization of silicic acid to form high polysilicic acid. But, the over-amount of fluorine will depolymerize the

high polysilicic acid to form active silicic acid. Aluminium and iron are complexed with fluorine and inhibit the effect of free fluorine in solution. The high polysilicic acid can be removed by adding polyether.

8477 **(FRNC-TH—3161) Uranium extraction process in a sulfuric medium by means of liquid emulsified membranes.** Monteillet, A. (Ecole Nationale Superieure des Mines, 75 - Paris (France)). Feb 1985. 183p. (In French). NTIS (US Sales Only), PC A09/MF A01. Order Number DE88751737/JAW.

Uranium ore processing, after leaching by sulfuric acid, by liquid-liquid extraction is a rather heavy process, not suitable for small deposits. Extraction by emulsions was suggested. In this process the leachate is contacted with an oil in water type emulsion, a liquid organic membrane is formed by the continuous phase. Uranium complexes diffuse through the liquid membrane towards the dispersed aqueous phase of the emulsion (stripping solution). Uranium is recovered by breaking the emulsion. Are successively studied: development of stable emulsions, influence of emulsion composition on uranium transfer kinetics, transfer mechanisms through the membrane and modelling of kinetics data obtained in the experimental study.

8478 **Actinides.** Reavis, J.G. (Los Alamos National Lab., NM). pp 5-71 of Molten salt techniques. Volume 3. Lovering, D.G.; Gale, R.J. (eds.). New York, NY; Plenum Press (1987).

The potentially destructive aspects of energy release from actinides have been widely discussed by the popular communications media. What is less widely known is that useful energy may be derived from recoverable actinides (uranium and thorium) which is 5 to 20 times as great as the energy available from all recoverable fossil fuels. This fact should establish the economic importance of developing efficient processes for preparing thorium, uranium, plutonium, and their compounds. Molten salt techniques used in studies of actinide compounds are similar to those used in studies of rare-earth and alkaline-earth compounds, but there are important differences. All of the actinides are radioactive, and working with them requires special health protection measures. Another hazard of working with plutonium and enriched uranium is that a critical mass may be inadvertently assembled. Many of the techniques discussed by the author apply equally well to working with nonactinides. Among the topics presented by the author are special enclosures required for actinides, materials problems, microtechniques, techniques for purification of multigram quantities of actinides and their salts, metal preparation and purification, physical properties measurements, absorption spectra, and electrochemistry.

0505 Uranium Enrichment

8479 **Computer extended series for a thermally driven gas centrifuge.** Berger, M.H. (Oak Ridge National Lab., TN, USA). *International Journal for Numerical Methods in Fluids;* 6: No. 6, 395-401(Jun 1986). Contract AC05-84OR21400.

Linearized multidimensional, thermally driven flow in a gas centrifuge can be approximately described in regions away from the ends by Onsager's homogeneous pancake equation. Upon reformulation of the general problem, a new, simple and rigorous closed form, analytical solution is found by assuming a special separable solution and replacing the usual Ekman end cap boundary conditions with idealized impermeable, free slip boundary conditions. Then the flow may be described by an ordinary differential equation with solutions in terms of simple, classical functions. By identifying a small parameter, say epsilon, defining the semi-long bowl approximation, and assuming a power series expansion in epsilon, a sequence of asymptotic approximations to the master potential is obtained. The next higher order solution is determined using the 1-D pancake Green's function. This recursive process is carried out on the computer to find all the terms up to O(epsilon^4).

0508 Spent Fuels Reprocessing

REFER ALSO TO CITATION(S) 8582, 8583, 8673, 8807, 8852, 8853, 8925, 9048, 9049

8480 **(BMU—1987-152) Disposal strategies for special wastes.** Bruecher, H.; Merz, E. (Bundesministerium fuer Umwelt, Naturschutz und Reaktorsicherheit, Bonn (Germany, F.R.); Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Chemische Technologie der Nuklearen Entsorgung). 1987. 147p. (In German). GRM Werbeberatung - Werbemittlung - PR, Eggenstein-Leopoldshafen, Germany, F.R.

Schriftenreihe Reaktorsicherheit und Strahlenschutz. Ergebnisberichte, Untersuchungen, Studien, Gutachten.

Special attention is being paid to the treatment and disposal of the volatile radionuclides tritium, carbon-14, krypton-85, and iodine-129 arising from reprocessing of spent nuclear fuel. This is shown by a large number of investigations on this subject as well as the 1983 recommendation of the German Radiation Protection Commission. Recent investigations on these four nuclides have been analysed, and it has been tried to draw conclusions for the realisation of the management concept for these radionuclides.

8481 **(CEA-R—5414) Pulse influence on the transfer kinetics between a drop and a liquid in the uranyl nitrate extraction by an hydrocarbon diluted tributylphosphate.** Binh, D. (Ecole Centrale des Arts et Manufactures, 92 - Chatenay-Malabry (France)). Dec 1985. 166p. (In French). (FRNC-TH—3165). NTIS (US Sales Only), PC A08/MF A01. Order Number DE88751731/JAW.

Extraction kinetics of uranyl nitrate by TBP diluted at 30% in a hydrocarbon is studied, especially transfer by diffusion in the case of droplets. Application is made to pulse columns. The study of transfer coefficient variations of the dispersed phase in the two cases (aqueous continuous phase then organic) shows that in the conditions of acidity corresponding to extraction the transfer coefficient is at most equal to solvation constant of uranyl nitrate by TBP, the maximum value is obtained for a continuous aqueous phase and for continuous organic phase diffusion resistance is important for small drops ($d < 2$ mm).

8482 **(DP-MS—87-65-Rev.1) Canyon solvent cleaning with activated alumina.** Reif, D.J. (Savannah River Lab., Aiken, SC (USA)). 1987. Contract AC09-76SR00001. 28p. (CONF-871101—43-Rev.1). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88002440/JAW.

From Joint meeting of the American Nuclear Society and the Atomic Industrial Forum; Los Angeles, CA, USA (15 Nov 1987).

This paper presents recent work at SRL concerning the cleaning of solvent extraction solvent used at SRP. The paper explains why we undertook the work, and some laboratory studies on two approaches to solvent cleaning, namely extended carbonate washing and use of solid adsorbents. The paper then discusses scale-up of the preferred method and the results of the full-scale cleaning. 19 figs.

8483 (IAEA-TECDOC—421, pp 129-146) **Experience of corrosion problems and material developments in the Tokai Reprocessing Plant.** Yamanouchi, T.; Aoshima, A.; Sasao, N.; Takeda, S.; Ishiguro, N. (Power Reactor and Nuclear Fuel Development Corp., Tokyo, Japan). May 1987. NTIS (US Sales Only), PC A10/MF A01. Order Number DE88700614/JAW. (CONF-860987—).

From Technical committee on materials reliability in the back end of the nuclear fuel cycle; Vienna, Austria (2 Sep 1986).

In Tokai Reprocessing Plant, several problems on the main process equipment have occurred due to the corrosion of the austenitic stainless steel. Under these circumstances, the plant operation was stopped for a long intermittent period in order for us to investigate the corrosion conditions and take necessary measures such as repair or replacement of failed equipment. In this paper, such problems and measures are summarized together with the de-

scription of the corrosion behaviors in reference to the dissolvers and acid recovery evaporator in the plant. 2 refs, 13 figs, 3 tabs.

8484 (IAEA-TECDOC—421, pp 165-192) **Zirconium use for large process components.** Chauve, H.; Decours, J.; Demay, R.; Pelras, M.; Turluer, G.; Simmonnet, J. (Societe Generale pour les Techniques Nouvelles S.G.N., 78 - Saint-Quentin-en-Yvelines, France; CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette, France. Inst. de Recherche Technologique et de Developpement Industriel, IRDI; CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92, France. Inst. de Recherche Technologique et de Developpement Industriel, IRDI; Cogema, Saint-Quentin en Yvelines, France). May 1987. NTIS (US Sales Only), PC A10/MF A01. Order Number DE88700614/JAW. (CONF-860987—).

From Technical committee on materials reliability in the back end of the nuclear fuel cycle; Vienna, Austria (2 Sep 1986).

Austenitic stainless steels display satisfactory behaviour in reprocessing facilities. However, certain failures are occasionally observed and usually ascribed to corrosion in oxidizing nitric media capable of bringing these materials close to or within the transpassive range. Zirconium does not present this drawback and helps to solve corrosion problems in these particularly aggressive conditions for stainless steels. Zirconium generally displays an outstanding general corrosion resistance in nitric acid media. In practice, however, its use in reprocessing facilities leads to the consideration of certain factors that may either restrict its application, or should be closely investigated. The most important among these are: fluoride content of the medium; nitrogen content of the metal; formation of possible insoluble compounds despite very low ionic release rates; stress corrosion cracking observed only in some severe laboratory testings. It was decided to use zirconium in the new facilities at La Hague for most of the weld-fabricated equipment treating boiling nitric solutions and for a number of specific process units (for example, reactors containing sulphides in acidic media). A total of 80 tons of zirconium will be employed, and 5,500 meters of piping circuits are being installed with this material. This was achieved through the development of semi-finished products (plates, pipes, etc.) with properties adapted to the construction of the large weld-fabricated units of nuclear chemistry. Shaping, welding and inspection specifications have been developed. Finally, the choice and development of zirconium were facilitated by the use of zirconium-stainless steel junctions allowing the connection of a zirconium unit to a stainless steel piping system. 7 refs, 22 figs, 5 tabs.

8485 (IAEA-TECDOC—421, pp 207-214) **Selection of materials for various systems in reprocessing fast reactor fuels - present status and future programme.** Gnanamoorthy, J.B.; Balasubramanian, G.R. (Indira Gandhi Centre for Atomic Research, Kalpakkam, India). May 1987. NTIS (US Sales Only), PC A10/MF A01. Order Number DE88700614/JAW. (CONF-860987—).

From Technical committee on materials reliability in the back end of the nuclear fuel cycle; Vienna, Austria (2 Sep 1986).

Choice of proper materials of construction for various applications in reprocessing of Fast Reactor fuels plays a vital role from considerations of safety and economics. A brief mention of process followed particularly for the reprocessing of mixed carbide fuel is made. The plant is classified into various functional zones based on severity of radiation and chemicals for the choice of materials such as highly radioactive cells, radioactive laboratories, low and high level waste storage areas, off-gas treatment section, etc. For each of the areas, the criteria for the selection of material is defined and based on that probable candidate materials are identified. Work carried out on corrosion studies related to the conventional and electrochemical dissolver and its components is described. Need for development of a specific code for the fast reactor fuel reprocessing industry is stressed. The paper also describes the facilities available in the Chemical Metallurgy Section for the corrosion studies and spells out the programme in the Centre for development of material needed for this part of the nuclear fuel cycle. 4 refs, 1 fig.

8486 (INIS-GB—13) **EDRP public local inquiry, UKAEA/BNFL precognition on: UKAEA/BNFL policy in relation to EDRP.** Allardice, R.H. (UKAEA Headquarters, London; British Nuclear Fuels Ltd., Risley). Jan 1986. 41p. (DP—1). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88750736/JAW.

The policy of the UKAEA and BNFL, for the design and construction of a fast reactor fuel reprocessing plant, and how it relates to UK Government policy for the development of the fast reactor system in collaboration with other European countries, is described. ((U.K.).

8487 (INIS-GB—14) **EDRP public local inquiry, UKAEA/BNFL precognition on: General description of fast reactor fuel reprocessing.** Allardice, R.H. (UKAEA Headquarters, London; British Nuclear Fuels Ltd., Risley). Jan 1986. 17p. (DP—2). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88750737/JAW.

An introduction to the general need for, and principles of, fast reactor fuel reprocessing is given. Reprocessing experience in the United Kingdom is outlined, and a description of the basic technology of fast reactor fuel reprocessing is presented. (U.K.).

8488 (INIS-GB—16) **EDRP public local inquiry, UKAEA/BNFL precognition on: EDRP gaseous emissions.** Walker, B.J. (UKAEA Headquarters, London; British Nuclear Fuels Ltd., Risley). Jan 1986. 8p. (DP—6). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88750739/JAW.

The Eureopean Demonstration Reprocessing Plant will be equipped with a comprehensive ventilation system to collect, and where appropriate treat, the various gaseous arisings from the plant as well as to provide a safe and comfortable working environment for the operators. The purpose of the treatment systems is to reduce the levels of those substances, both radioactive and non-radioactive, which would otherwise have an adverse effect on the environment if discharged without treatment. The ventilation system proposed for the main process areas and the associated treatment system is described.

8489 (INIS-GB—24) **EDRP public local inquiry, UKAEA/BNFL precognition on: EDRP process and plant.** Walker, B.J. (UKAEA Headquarters, London; British Nuclear Fuels Ltd., Risley). Jan 1986. 32p. (DP—4). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88750741/JAW.

A description is given of the process to be operated in the proposed EDRP, and of the plant and equipment in which the process will be carried out. The design and construction of new facilities to be provided on the EDRP site at Dounreay are detailed. (U.K.).

8490 (INIS-GB—25) **EDRP public local inquiry, UKAEA/BNFL precognition on: PFR fuel reprocessing and radioactive waste management at Dounreay.** Pugh, O. (UKAEA Headquarters, London; British Nuclear Fuels Ltd., Risley). Jan 1986. 34p. (DP—3). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88750742/JAW.

A description of PFR fuel reprocessing at Dounreay is given, including brief details of fuel assembly transport, dismantling, chemical separation processes and reprocessing experience. The origin of radioactive wastes from PFR reprocessing, and the types of radioactive waste are outlined. The management of radioactive waste, including storage, treatment and disposal is described. (U.K.).

8491 (INIS-GB—26) **EDRP public local inquiry, UKAEA/BNFL precognition on: Safety aspects of EDRP.** Brown, M.L. (UKAEA Headquarters, London; British Nuclear Fuels Ltd., Risley). Jan 1986. 82p. (DP—8). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88750743/JAW.

The safety of the proposed EDRP is discussed, paying particular attention to the environmental impact in both normal oper-

ation, and in abnormal or accident conditions. The radiological exposure resulting from EDRP discharges during normal operation is estimated. Design measures for ensuring worker and public safety during both routine and non-routine operation are outlined. The strategy for considering unlikely but potentially more serious accidents in EDRP design is outlined. (U.K.).

8492 **(INIS-GB—28) EDRP public local inquiry, UKAEA/BNFL precognition on: Contractor accommodation.** Scott, W. (UKAEA Headquarters, London; British Nuclear Fuels Ltd., Risley). Jan 1986. 4p. (DP—10). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88750744/JAW.

The availability of accommodation for contractors working on the proposed EDRP at Dounreay is discussed. It is predicted that the contractors could be accommodated without the need for special arrangement and with no adverse effect on the tourist industry. (U.K.).

8493 **(INIS-GB—29) EDRP public local inquiry, UKAEA/BNFL precognition on: Water supply.** Ward, D.L. (UKAEA Headquarters, London; British Nuclear Fuels Ltd., Risley). Jan 1986. 6p. (DP—11). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88750753/JAW.

The eventual water requirement for the proposed EDRP at Dounreay is estimated to be about 400m³/day. It is concluded that the additional requirement to the existing needs of the Dounreay Nuclear Establishment will have no significant effect on the total extraction rate from Loch Shurrery or on the operation of the present water treatment plant at Shebster.

8494 **(INIS-GB—33) EDRP public local inquiry, UKAEA/BNFL precognition on: Risk targets and EDRP design.** Brown, M.L. (UKAEA Headquarters, London; British Nuclear Fuels Ltd., Risley). Jun 1986. 112p. (DP—8-Add.1). NTIS (US Sales Only), PC A06/MF A01. Order Number DE88750762/JAW.

A full description is presented of the extent to which risk is controlled by the targets to be implemented in the proposed EDRP design, including a discussion of a particular accident sequence. Risk expressions and the usefulness of risk criteria are reviewed. Details are given of the accident consequence modelling as used by the UKAEA. Terrorist attack and sabotage are briefly discussed.

8495 **(INIS-GB—40) [EDRP public local inquiry] statement by H.M. Nuclear Installations Inspectorate of the Health and Safety Executive. Public enquiry into the joint proposal by the United Kingdom Atomic Energy Authority and British Nuclear Fuels plc to construct a fast reactor fuel reprocessing plant at Dounreay Nuclear Power Development Establishment, Caithness.** (Health and Safety Executive, London (UK). Nuclear Installations Inspectorate). 24 Jan 1986. 13p. (NII-P—1). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88750803/JAW.

An outline is given of the regulatory system, and the administrative and technical review procedures which would be applied before the licence and subsequent authorisations were granted. How the Inspectorate would set about its task of examining the operators safety case is also indicated. (U.K.).

8496 **Solvent extraction in nuclear technology.** Navratil, J.D. (Rockwell International Corp., Golden, CO, USA. Rocky Flats Plant). *Pure and Applied Chemistry;* **58**: No. 6, 885-888(Jun 1986).

Some aspects of solvent extraction chemistry in the field of nuclear technology are briefly reviewed. Applications of solvent extraction in actinide recovery and purification, radionuclide production, and reactor materials preparation are summarized. The need for new, more selective, solvent extraction reagents is presented via examples of recent work with bifunctional organophosphorus reagents applied to the removal of actinides from acidic radioactive waste solutions.

0509 Transport And Storage

REFER ALSO TO CITATION(S) 9051, 9262, 9284, 9285, 9286

8497 **(EUR—10639) Global approach to a transport system for radioactive waste-case study: radioactive drugs.** Brenot, J.; Gilles, P.; Poisot, J.P.; Scheidhauer, J.; Vinarnick, L. (CEA, 75 - Paris, France. IPSN; Compagnie ORIS-Industrie, 91 - Gif-sur-Yvette, France; CEA, 75 - Paris, France. CIREA). (Commission of the European Communities, Luxembourg). 1986. 92p. (In French). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88751581/JAW.

For the year 1984 in France: radionuclides in unsealed sources, used in medical circles represent 4812 Ci (4812 x 37 GBq) of which 80% for Technetium 99 m alone. The market for these products has expanded greatly in fifteen years, by at least a factor of 6. the parcels are in the number of at least 200 000 of which 120 000 parcels are A labelled containing radiopharmaceutical preparations administered in vivo and radiochemical preparations used in vitro or in research. the users are few in number, 375 in all, of whom 127 are Departments of Nuclear Medicine who are the principal users; deliveries are very regular and are made along some large axes. transport accidents are extremely rare. the dosimetric data of workers are of a quality and equivalent of the collective dose for workers is in the order of 0.42 h.Sv; furthermore this equivalent of the collective dose has been recognisably the same for 15 years despite the increases in personnel and production; within the present framework of regulations concerning transport of the parcels, radioprotection of workers depends on the ethics of the suppliers. The drivers, who transport radioactive parcels only are regularly exposed to more than 10 mSv per year and the study of this group of workers should be a priority. The distribution of the doses received by packers in the large transit centres is not known. The equivalent of the collective public dose, due to the transport of these unsealed sources for medical use must be between 0.01 h.Sv and 0.1 h.Sv.

8498 **(HE-TP—28030) Transport implications of siting policies for the disposal of low-level radioactive wastes.** James, I.A. (Hunting Engineering Ltd., Bedford (UK)). Jan 1986. 48p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88750682/JAW.

This report has been produced to be complementary to the previously issued report "The Transport Implications of Regional Policies for The Disposal of Intermediate Level Radioactive Wastes". The same combinations of disposal facilities have been used so that direct comparison with intermediate waste results can be made. Low level wastes and short-lived intermediate level wastes for near-surface disposal are assumed to share a common infrastructure on the rail system and hence a methodology of separating total costs between these two waste types has been derived. Two transport modes, road and rail have been analysed. Hybrid transport, a combination of road and rail systems, has not been examined since no site is considered to produce sufficient waste to justify a dedicated rail service. Sellafield, has not been included in this examination since it is assumed to be served by its own disposal site at Drigg.

8499 **(INIS-GB—31) EDRP public local inquiry, UKAEA/BNFL precognition on: Irradiated fuel and waste transport.** Milne, W.G. (UKAEA Headquarters, London; British Nuclear Fuels Ltd., Risley). Feb 1986. 28p. (DP—13). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88750755/JAW.

The experience gained in the transport of radioactive materials is described and its relevance to the proposed movements of fast reactor irradiated fuel and reprocessing wastes is outlined. Proposed methods of transport, flask design, road/rail movements and safety requirements are briefly reviewed.

8500 **(INIS-GB—32) EDRP public local inquiry, UKAEA/BNFL precognition on: Port rail and road options for the transport of irradiated fuel and waste.** Weaver, J. (UKAEA Headquarters, London; British Nuclear Fuels Ltd., Risley). Feb 1986. 35p. (DP—14). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88750756/JAW.

The technical feasibility and impact of the proposed transport links required for the EDRP site at Dounreay is assessed. The transport requirements for the proposed EDRP are outlined and the modifications/extensions to the existing systems which would be necessary are discussed.

8501 **(INIS-GB—34) EDRP public local inquiry, UKAEA/BNFL precognition on: the transport of irradiated fuel by rail.** Singleton, L. (UKAEA Headquarters, London; British Nuclear Fuels Ltd., Risley). Feb 1986. 20p. (DP—15). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88750763/JAW.

The experience in handling of irradiated fuel flasks by the British Railways Board is outlined. The steps taken to ensure the effective and safe transport of irradiated fuel and nuclear waste by rail are identified. It is concluded that the proposed rail transport link to the EDRP at Dounreay should prove practicable.

8502 **(INIS-GB—35) EDRP public local inquiry, UKAEA/BNFL precognition on: The transport of the plutonium and uranium products from the EDRP.** Wilson, P.W. (UKAEA Headquarters, London; British Nuclear Fuels Ltd., Risley). Feb 1986. 5p. (DP—16). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88750764/JAW.

Details are given of the design of a container for plutonium transport. The handling of the containers, and their transport, from the proposed EDRP at Dounreay, including security and emergency arrangements, are described. The arrangements for the transport of depleted uranium are briefly outlined.

8503 **(INIS-GB—36) EDRP public local inquiry, UKAEA/BNFL precognition on: Safety aspects of transport.** Brown, M.L. (UKAEA Headquarters, London; British Nuclear Fuels Ltd., Risley). Feb 1986. 17p. (DP—17). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88750765/JAW.

The transport of spent fuels and radioactive wastes by rail, sea and air is considered in the light of the proposed EDRP at Dounreay. The frequency and severity of accidents and the risks and consequences are discussed for each mode of transport.

8504 **(INIS-GB—37) EDRP public local inquiry, UKAEA/BNFL precognition on: Marine operations.** Bristow, J.W. (UKAEA Headquarters, London; British Nuclear Fuels Ltd., Risley). May 1986. 6p. (DP—18). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88750766/JAW.

Marine operations connected with the proposed EDRP at Dounreay are outlined. The vessel and its operation, and the port facilities required are briefly described.

8505 **(INIS-GB—41) [EDRP public local inquiry] Statement by the Department of Transport. Application by the United Kingdom Atomic Energy Authority and British Nuclear Fuels plc jointly for outline planning permission for the construction and operation of a reprocessing plant for fast reactor fuel.** (Department of Transport, London (UK)). 1985. 11p. (DOTp-P—1). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88750777/JAW.

The safety responsibilities of the UK Secretary of State for Transport, in relation to radioactive materials under normal and accident conditions of transport, are outlined. The basic regulatory requirements necessitated by the IAEA regulations for safe transport of radioactive materials are summarised. A list of national and international regulations concerning the safe transport of radioactive materials to, from, or within the UK is provided. (U.K.).

0510 Marketing, Economics, And By-products

8506 **(FRNC-TH—3159) Technico-Economical study of retreated uranium reenrichment.** Patillon, L. (Ecole Centrale des Arts et Manufactures, 92 - Chatenay-Malabry (France)). Mar 1985. 213p. (In French). NTIS (US Sales Only), PC A10/MF A01. Order Number DE88751607/JAW.

Spent fuel from nuclear power plants is reprocessed at La Hague reprocessing plant in France. Recovered and stored reprocessed uranium has an energy potential unutilized so far. A modelisation is proposed in this paper for evaluating the economic interest reprocessed uranium reenrichment for using it again in a power plant. After briefly recalling the fuel cycle in light water reactors and reprocessed uranium specificities, a mathematical model for multi-isotope enrichment gives a differential system governing isotopic separation. Different solutions are proposed and compared. A. de la Garza analytical model's is retained. An economic value is attributed to reprocessed uranium. Results are presented as curves for determining the sensitivity of this value to simulation parameters (natural uranium cost, enrichment required by the electricity board etc.).

0520 Waste Management

REFER ALSO TO CITATION(S) 8480, 8488, 8490, 8496, 8498, 8807, 9026, 9043, 9044, 9046, 9047, 9051, 9177, 9178, 9241, 9284, 9285, 9286, 9320, 9325, 9501, 9515, 9516

8507 **(AEEW-R—1951) Incorporation of low and medium level radioactive wastes (solids and liquids) in cement. Final report.** Palmer, J.D.; Smith, D.L. (UKAEA Atomic Energy Establishment, Winfrith). Jul 1985. 117p. NTIS (US Sales Only), PC A06/MF A01. Order Number DE88750723/JAW.

Experimentation has shown that high temperatures generated during the setting of ordinary Portland cement/simulant waste mixes can be significantly reduced by the use of a blend of ground granulated blast furnace slag and ordinary Portland cement. Trials on simulated waste showed that blended cement gave improved stability and a reduction in leach rates, and confirmed that the cement-based process can be used for the immobilisation of most types of low and medium level waste. (U.K.).

8508 **(AERE-G—3411) Integral migration and source term experiments on cement and bitumen waste forms. Final report.** Ewart, F.T.; Howse, R.M.; Sharpe, B.M.; Smith, A.J.; Thomason, H.P.; Williams, S.J.; Young, M. (UKAEA Atomic Energy Research Establishment, Harwell. Chemistry Div.). Jan 1986. 40p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88750801/JAW.

This is the final report of a programme of research which formed a part of the CEC joint research project into radionuclide migration in the geosphere (MIRAGE). This study addressed the aspects of integral migration and source term. The integral migration experiment simulated, in the laboratory, the intrusion of water into the repository, the leaching of radionuclides from two intermediate level wasteforms and the subsequent migration through the geosphere. The simulation consisted of a source of natural ground water which flowed over a sample of wasteform, at a controlled redox potential, and then through backfill and geological material packed in columns. The two wasteforms used here were cemented waste from the WAK plant at Karlsruhe, W. Germany and bitumenised intermediate concentrates from the Marcoule plant in France. The soluble fission products such as caesium wire rapidly released from the cemented waste but the actinides, and technetium in the reduced state, were retained in the wasteform. The release of all nuclides from the bitumenised waste was very low.

8509 **(AERE-G—3562) Experimental study of the recovery of plutonium from non-combustible wastes. Final report, April 1983-April 1985.** Chamberlain, H.E.; Datton, J.T.; Gaudie, S.C.; Wilkins, J.D.; Dawson, R.K.; Turner, A.D. (UKAEA Atomic Energy Research Establishment, Harwell. Chemistry Div.). Dec 1985. 73p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE88750681/JAW.

Removal of loose PuO_2 from non-combustible plutonium contaminated waste by Arklone (1,1,2 trichloro, 1,2,2-trifluoro ethane) has been demonstrated on a laboratory scale. While aqueous containing media are generally more effective decontaminants, Arklone has the advantages of being non-moderating and easily recycled by distillation. Although low pressure spraying and vibrocleaning are effective contacting methods, ultrasonics gave the highest DF's -reducing residual Pu levels to 1-10 $\mu g/cm^2$. Lower levels are unattainable in a simple batch process due to redeposition of particulates in small surface flaws. More aggressive processes are needed to achieve further decontamination - such as paint stripping from mild steel followed by treatment with Marshall's solution ($< 10^{-4}$ $\mu Ci/cm^2$), or electrochemical decontamination for stainless steel ($< 10^{-5}$ $\mu Ci/cm^2$). Microscopic smoothness has been identified as the most significant parameter in determining PuO_2 retention and subsequent ease of decontamination. To maintain this, radiation resistance is important, as also is surface hardness under abrasive conditions. For facility walls and ceilings, therefore, electropolished stainless steel, 316L or PEEK foil faced GRP, and epoxy paint (treated with fine TiO_2 to block any surface defects) are recommended to reduce residual PuO_2 to < 1 $\mu g/cm^2$ after ultrasonic washing, while work-hardened polish rolled stainless steel and bright nickel or chrome electro-plates are suggested to achieve similar levels on the floor.

8510 **(AERE-G—3589) Measurement of the loading of vitrified waste by x-ray absorptiometry.** Taylor, B.L.; Johnson, J.; Russen, L.C.; Metcalfe, B. (UKAEA Atomic Energy Research Establishment, Harwell. Instrumentation and Applied Physics Div.). Mar 1986. 12p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88750748/JAW.

Absorptiometric measurements on inactive simulants of HA vitrified waste have been carried out using a narrow beam of x-rays from an x-ray tube generator and a high resolution solid state detector. A functional relationship between the transmitted beam intensity and the percentage loading of the glass has been established. In addition, certain of the fission product elements can be individually identified and measured by analysing the absorption edge structure in the 18-50 keV region. Measurement of an active glass sample (approx. 0.4 Ci $\beta\gamma$) has shown that the radiations from the sample do not interfere with the absorptiometry.

8511 **(AERE-G—3598) Electrical processes for the treatment of medium active liquid wastes. Final report January 1983-April 1985.** Turner, A.D.; Bowen, W.R.; Bridger, N.J.; Junkinson, A.R.; Cox, D.R. (UKAEA Atomic Energy Research Establishment, Harwell. Materials Development Div.). Jul 1985. 214p. NTIS (US Sales Only), PC A10/MF A01. Order Number DE88750684/JAW.

Cross-flow electrokinetic dewatering has been developed on a lab-scale into an effective process for the treatment of such wastes as gravity-settled flocs, or sludges arising from fuel storage. The product may be concentrated to 25-42% solids while still remaining fluid, prior to immobilization - e.g. by addition of cement powder. Complete retention of activity in the concentrate was observed during the treatment of Harwell low-level waste sludges due to the high solids separation factor ($> 10^4$). It is a low pressure, low temperature process - consuming only 0.03-0.13 kWh/L at permeation rates of 0.3-1.5 m/h (depending on the stream), corresponding to 1/67 - 1/15 that needed for evaporation. An advanced electrochemical ion-exchange system has been developed in which ionic material can be electrically adsorbed and eluted by polarity reversal $>$ 1000 times, without any change in performance. Decontamination factors of about 2000 were achieved for Cs removal, up to 75% loading of the exchanger at flow rates of 8 bed volumes/h. Elution into water can give concentrates of $>= 0.25$ M - with consequent high volume reduction factors. Inorganic ion-exchangers have also demonstrated system selectivity for the removal of specific cations. Overall energy consumption is < 5 kWh/m^3 (1/400 evaporation). Significant cost savings over conventional ion-exchange may accrue from the improved performance under electrical control, and the reduced volumes of waste requiring disposal.

8512 **(AERE-G—3603) Evaluation of Arklone for the decontamination of non-combustible plutonium contaminated materials.** Gaudie, S.C.; Wilkins, J.D.; Turner, A.D. (UKAEA Atomic Energy Research Establishment, Harwell. Chemistry Div.; UKAEA Atomic Energy Research Establishment, Harwell. Materials Development Div.). Apr 1986. 52p. (DDTF—77; PCMRP—85-P-7). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88750795/JAW.

The use of Arklone (1,1,2 trichloro-, 1,2,2 trifluoroethane) as a decontamination reagent for plutonium contaminated non-combustible wastes has been investigated on a laboratory scale. Arklone has been found to be effective for the removal of loose PuO_2 contamination -in particular from organic surfaces - from both synthetic and genuine waste. Of the range of contacting techniques investigated, ultrasonics was the best, though vibrocleaning and low pressure spraying performed well. For painted mild steel, paint stripping followed by treatment with Marshall's solution (an aqueous solution of oxalic acid and hydrogen peroxide) cleaned the surface to below 10^{-4} $\mu Ci/cm^2$. Alternatively , electrochemical techniques could be used - particularly electrodissolution in nitric acid for stainless steel - to reduce contamination levels to 10^{-6} $\mu Ci/cm^2$.

8513 **(AERE-G—3696) Effects of hydrostatic pressure on the integrity of concrete. Pt. 2. Preliminary studies on monolithic blast furnace slag/cement under simulated sea disposal conditions.** Dawspm, D.M.; Briggs, A. (UKAEA Atomic Energy Research Establishment, Harwell. Materials Development Div.). Jan 1986. 21p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88750699/JAW.

Part 1 - AERE-G-3476.

The effects of simulated sea dumping conditions on some physical properties of 9:1 blast furnace slag-ordinary Portland cement (BFS-OPC) grout are described. Using measurements of ultrasound transit time and diametral compression strength it has been shown that minor degradation occurs during pressurisation/depressurisation treatment, and that less degradation occurs when the grout is pressurised in air than when it is open to the ingress of water. It is inferred that microcracking or matrix/inclusion separation occurs during pressurisation, but it is predicted that such cracking might self-heal in the presence of water as a result of continued cement hydration. The mass properties of the material are not altered significantly by the degradation resulting from pressurisation/depressurisation treatment. On the basis of its behaviour under pressurisation, 9:1 BFS-OPC mixture is considered to be suitable for use as either a matrix material in monolithic packages or a grout for composite packages for sea disposal.

8514 **(AERE-G—3753) Examination of failed components from the 1/3rd scale Joule Ceramic Melter.** Evans, J.P.; Paige, E.L. (UKAEA Atomic Energy Research Establishment, Harwell. Chemistry Div.). Jan 1986. 44p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88750780/JAW.

Samples from components of the one third scale Joule Ceramic Melter have been examined by optical and electron microscopy in order to investigate the reasons for the severe corrosion observed, particularly in the Inconel 690 electrodes. Samples were taken from a number of regions of the most corroded electrode and from the Inconel 690 thermocouple sheath and glass withdrawal pipe for comparison. The attack was found to be of two forms: one comprising an oxidation mechanism, seen in all inconel 690 samples, spearheaded by penetration along grain boundaries, to form a chromium-rich oxide that was dissolved by the molten waste glass: the second form, melting, was seen in the most severely corroded electrode regions, and the excessive temperatures required for melting to occur were most probably caused by localised high current densities due to the presence and segregation of metallic precipitates to the bottom region of the melter chamber. (author).

8515 **(AERE-G—3754) Preliminary experiments to simulate glass/electrode interactions within a Joule Ceramic Melter.** Dalton, J.T.; Paige, E.L.; Sutcliffe, P.W. (UKAEA Atomic Energy Research Establishment, Harwell. Chemistry Div.). Jan 1986. 13p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88750769/JAW.

Preliminary isothermal corrosion tests have been made on Inconel 690 coupon samples immersed in Harvest II M9 glass with and without excess additions of Li_2O (1.5%) and RuO_2) (20%) together with TeO_2 (2%) at 1200°C for periods up to 100 hours. Inconel 690 corrosion and the products and ruthenium redox conditions within the glass approximate to those observed in the 1/3rd scale Joule Ceramic Melter operations. Corrosion takes place by an oxidation mechanism to form a chromium-rich surface oxide, and dissolution of this surface oxide by the surrounding glass. Additions of excess Li_2O increase the corrosion rate of Inconel 690, whereas RuO_2 + TeO_2 are neutral. The latter however have a marked effect in lowering the room temperature resistivity by at least 5 orders of magnitude even though relatively small fraction of the RuO_2 precipitates were reduced to ruthenium metal.

8516 **(AERE-G—3789) Effects of hydrostatic pressure on the integrity of concrete. III. A study on the effects of inclusions in concrete under simulated sea-disposal conditions.** Dawson, D.M.; McGahan, P. (UKAEA Atomic Energy Research Establishment, Harwell. Materials Development Div.). Apr 1986. 24p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88750751/JAW.

The effects of model inclusions on the properties of concrete subjected to simulated sea disposal conditions are described. From measurements of ultrasound transit time and diametral compression strength it has been shown that metal, ceramic and polymeric inclusions, or voids, at up to 11sup(v)/o loading, have no deleterious effect on cementitious matrix properties during pressurisation to 50 MPa and subsequent depressurisation. The formation of a narrow compaction zone around hard inclusions has been confirmed and its formation can be attributed to the difference in local elastic modulus between the cement matrix and the inclusion. No other matrix cracking was observed. A number of cementitious matrix systems have been studied and from mechanical strength, and strength degradation during pressurisation it is suggested that a 9:1 blast furnace slag/ordinary Portland cement composition is more suitable for the sea-disposal route for wastes than the currently used concrete.

8517 **(AERE-M—3373) Microwave vitrification - the development of a full-scale inactive plant.** Morrell, M.S.; Smith, M. (UKAEA Atomic Energy Research Establishment, Harwell. Chemical Engineering Div.). Jan 1986. 15p. H.M. Stationery Office, London, price Pound 4.00.

The full scale evaporation stage of a Microwave Vitrification plant was developed to a point where the plant could be operated for up to three hours and at feedrates of up to thirty litres per hour of HAL simulant. For further progress to be achieved the microwave applicator would have to be redesigned to achieve more uniform power absorption. The microwave evaporation stage used a process tube of 226mm diameter and of 1m working length between off-gas outlet and dried plug discharge. Experiments with static plugs showed that a fibre glass plug could be used in the evaporation of many times its own weight of feedstock. Subsequent work with a moving train of plugs confirmed that plug movement through a full-scale plant was practical.

8518 **(AERE-M—3496) Pictorial view of radionuclide migration from a deep underground repository for cemented intermediate-level waste.** Herbert, A.W.; Hodgkinson, D.P.; Rae, J. (UKAEA Atomic Energy Research Establishment, Harwell. Theoretical Physics Div.). Nov 1985. 21p. H.M. Stationery Office, London, price Pound 5.00.

The note presents a series of pictures which illustrate the expected effect of various barriers, which inhibit the migration of radionuclides from a deep underground repository for cemented intermediate-level waste. The results for the geological barrier are based on finite-element calculations performed using representative parameters, as detailed in an appendix.

8519 **(AERE-R—11130) Review of alternative wasteforms and processes for future solidification of high-level liquid wastes.** Cains, P.W.; Walmsley, D.; Marples, J.A.C. (UKAEA Atomic Energy Research Establishment, Harwell. Chemical Engineering Div.). Apr 1986. 94p. H.M. Stationery Office, London, price Pound 7.00.

A catalogue of alternative wasteforms proposed for the solidification of high-level liquid wastes has been compiled, together with an appraisal of their suitability for longer-term future UK waste immobilisation. The properties of the more promising alternatives have been critically reviewed, and an attempt has been made to ascertain the feasibility of their manufacture under realistic process conditions. The analysis suggests that the alternative wasteforms/processes showing most potential for future development are the durable glasses and SYNROC.

8520 **(AERE-R—11550) Development of a dry frit (crizzle) feed for vitrification processes.** Walmsley, D.; Hollinrake, A.; Morris, J.B. (UKAEA Atomic Energy Research Establishment, Harwell. Chemical Engineering Div.). Apr 1986. 30p. H.M. Stationery Office, London, price Pound 5.00.

An important variable in any vitrification process is the nature of the glass-former feedstock used to convert the waste to glass. During most of the development work on the HARVEST full-scale inactive pilot plant the glass-formers were added as a slurry of the separate chemicals (the same technique as used in the earlier FINGAL programme). However, the water in the slurry imposed a significant additional thermal load on the system. This report describes the development of a dry frit (crizzle) feed and this showed that the reduced thermal burden of the dry feed process enabled the throughput to be doubled. Process stability is excellent with none of the random pressure surges which occurred with the slurry feed system. No change in operating temperature is necessary to produce a glass of comparable quality to that obtained with the slurry system. Carryover into the off-gas system was significantly reduced and no serious obstruction to gas flow developed. In contrast to the slurry system, cooling of the off-gas system was not required.

8521 **(AERE-R—11615) Quality checking studies on 210 litre drums containing sealed plutonium sources in two cement matrices.** Lambert, K.P.; Leake, J.W.; Wakefield, G. (UKAEA Atomic Energy Research Establishment, Harwell. Instrumentation and Applied Physics Div.). Feb 1986. 38p. (PCMRP—85-P17). H.M. Stationery Office, London, price Pound 5.00.

This paper reports work performed on 210 litre drums of both concrete and simulated soft waste immobilised with a cement grout which contain re-entrant tubes located in a series of radial positions. Sealed plutonium sources were inserted into the re-entrant tubes and the drums subjected to plutonium measurements using the above three techniques; comparisons being made between the assay data obtained from the plutonium sources in the empty drums and after filling with concrete and the waste-grout mixture. It is concluded that high resolution gamma spectrometry as implemented on the segmented gamma scanner and both total and coincidence neutron counting are suitable techniques for the quality checking of 210 litre drums of immobilised soft waste; the paper reports detection limits, precision and accuracy for these assay techniques.

8522 **(AERE-R—11627) Specification of a test problem for HYDROCOIN level 2 case 1: thermal convection and conduction around a field heat transfer experiment.** Hodgkinson, D.; Herbert, A. (UKAEA Atomic Energy Research Establishment, Harwell. Theoretical Physics Div.). Nov 1985. 28p. H.M. Stationery Office, London, price Pound 5.00.

This paper specifies a test problem which is to be used to validate models of coupled groundwater flow and heat transfer, as part of the international HYDROCOIN project. It is based on a field heat transfer experiment in which forced and free convection of water appear to perturb the temperature field due to thermal conduction through the rock. Descriptions of site characteristics

and experimental procedures are given together with details of the measured data which are to be used to calibrate models and validate their predictions.

8523 **(AERE-R—11735) Extension to unsaturated flow of the finite-element program NAMMU for coupled heat and groundwater flow.** Jackson, C.P.; Williams, M.G. (UKAEA Atomic Energy Research Establishment, Harwell. Theoretical Physics Div.). Sep 1985. 47p. H.M. Stationery Office, London, price Pound 5.00.

NAMMU is a finite-element program for modelling coupled heat and groundwater flow. The paper describes the extension of NAMMU to unsaturated flow. Modifications to the equations are discussed, including boundary conditions and the difficulties caused by seepage faces. This first unsaturated flow version allows arbitrary nonlinearities of capillary pressure and relative permeability, which are handled by the Newton-Raphson method; but does not allow for hysteresis of capillary pressure. An example calculation is presented, for a simple drainage ditch.

8524 **(AERE-R—11929) Review of the groundwater flow modelling of the Swiss Project Gewaehr.** Robinson, P.C.; Jackson, C.P.; Herbert, A.W.; Atkinson, R. (UKAEA Atomic Energy Research Establishment, Harwell. Theoretical Physics Div.). Feb 1986. 32p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88750746/JAW.

The authors review the hydrogeological modelling work undertaken by NAGRA (National Co-operative for the Storage of Radioactive Waste) for Project Gewahr (Guarantee). The FEM301 computer code that was used by NAGRA, their general approach to flow simulation and the specific finite-element models employed are all discussed; and the results of a verification are presented using the authors' own computer code NAMMU. Recommendations for improvements in the NAGRA modelling and for areas of future work are made.

8525 **(AERE-R—11943) Effects of radiation on polymer and bitumen matrix waste forms.** Phillips, D.C.; Johnson, D.I.; Burnay, S.G.; Hitchon, J.W. (UKAEA Atomic Energy Research Establishment, Harwell. Materials Development Div.). Jan 1986. 44p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88750747/JAW.

Results are presented on the effects of gamma and alpha radiations on polymer and bitumen matrix waste forms, in connection with the characterization of low and medium level radioactive waste forms. The experiments were carried out on behalf of the Commission of the European Communities and the Department of the Environment. The investigations on the organic waste forms included i) dimensional stability, mechanical integrity and weight change ii) gas evolution iii) leaching iv) alpha damage and v) fully active.

8526 **(AERE-R—11944) Verification of NAMMU using HYDROCOIN Level 1 cases 1 and 7: transient flow from a borehole and saturated flow through a shallow land disposal facility.** Herbert, A. (UKAEA Atomic Energy Research Establishment, Harwell. Theoretical Physics Div.). Oct 1985. 31p. H.M. Stationery Office, London, price Pound 5.00.

The numerical accuracy of the finite-element groundwater flow code NAMMU has been verified using test cases 1 and 7 from HYDROCOIN Level 1. Case 1 compares calculated results with an analytic solution to an idealised transient borehole experiment in a porous medium with a single horizontal fracture. The numerical results are in excellent agreement with the analytic solution, both for the pressure values and for the gradients. Our use of lower-dimensional elements to represent fractures is also verified in this test case, again with excellent agreement. Case 7 involves calculating flow through an idealised shallow land disposal facility in argillaceous media, and verifies a code's ability to model the spacially varying permeabilities which would be found in the vicinity of this type of facility. Since there is no analytical solution for this case, the results from independently developed codes have been intercompared. Considerable refinement of the grid was found necessary in the neighbourhood of the concrete engineered barriers, and near the outflow. With this refinement, the results from NAMMU compared well with results from other codes participating in the HYDROCOIN project.

8527 **(AERE-R—11952) Verification of NAMMU using HYDROCOIN Level 1 Case 4: transient thermal convection in a saturated permeable medium.** Cherrill, T.P.; Herbert, A.W. (UKAEA Atomic Energy Research Establishment, Harwell. Theoretical Physics Div.). Oct 1985. 23p. H.M. Stationery Office, London, price Pound 4.00.

The numerical accuracy of the finite-element groundwater flow code NAMMU has been verified using test case 4 of the international HYDROCOIN project. This test case compares results with the analytical solution to a problem of transient thermal convection driven by a spherical heat source in an infinite isotropic homogeneous saturated permeable medium. The properties used in the model were chosen to be typical of those relevant to the disposal of heat-emitting radioactive waste. With minor modifications to deal with this idealised problem, we found good agreement between results calculated by NAMMU and the analytical solution.

8528 **(AERE-R—11984) Review of the literature relating to radiolytic oxidation.** Walters, W.S.; Wisbey, S.J. (UKAEA Atomic Energy Research Establishment, Harwell. Chemistry Div.). Jun 1986. 24p. H.M. Stationery Office, London, price Pound 4.00.

A review of the literature relating to radiolytic oxidation has been undertaken. References of direct relevance to radioactive waste disposal are scarce, but by reporting in three sections concerned with: fundamental processes: radiolysis in acid solutions; and radiolytic oxidation in the environmental context, a substantial body of information has been assembled.

8529 **(AERE-R—11992) Preliminary studies on the effect of radiolytic oxidation on radionuclide solubility.** Wisbey, S.J. (UKAEA Atomic Energy Research Establishment, Harwell. Chemistry Div.). Feb 1986. 4p. H.M. Stationery Office, London, price Pound 5.00.

Preliminary studies of the radiolytic oxidation of certain radionuclides, to simulate their behaviour in a repository subject to water ingress and simultaneous irradiation have been conducted. Irradiated samples of technetium and neptunium have shown substantial oxidation to soluble forms, while plutonium has shown rather less, and americium very little indeed. For technetium and plutonium, a range of conditions have been studied including the effect of pH, Eh, presence of solid minerals or metallic iron.

8530 **(AERE-R—12023) Literature survey of the possible effects of humic and fulvic acids on the disposal of LLW and ILW.** Ewart, F.T.; Williams, S.J. (UKAEA Atomic Energy Research Establishment, Harwell. Chemistry Div.). Mar 1986. 26p. H.M. Stationery Office, London, price Pound 4.00.

A review has been made of the literature on the interactions of radionuclides with humic acids taking note of the chemical conditions which may be present under possible land disposal options for low and intermediate level wastes. The quantities and molecular weights of dissolved organic carbon are determined by the nature of the site under investigation. Complexation data is limited and cannot be used to reliably predict solubilities. No work on the influence of humic acids on the sorption properties of the actinides or technetium on near-field components has been reported. In the far-field of a repository constructed in a clay bed, only a small fraction of the total organic carbon may be mobile under natural conditions. The majority may be bound to clay minerals and provide a significant sink for radionuclide sorption. It is concluded that there is a requirement for further work in this area and some possible experimental investigations are discussed.

8531 **(AERE-R—12049) Durability of concrete in radioactive waste packages for sea disposal.** Atkinson, A.; Hearne, J.A. (UKAEA Atomic Energy Research Establishment, Harwell. Materials Development Div.). Nov 1985. 40p. H.M. Stationery Office, London, price Pound 5.00.

Current knowledge relating to the behaviour of concrete in seawater is reviewed, and its relevance to the disposal of radioactive waste packages in the deep ocean is assessed. The subject is discussed under the following topic headings: experience with cement and concrete in seawater, concrete in deep ocean, rate of

interaction between concrete and seawater, and degradation sequence for sea disposal packages and release of radionuclides.

8532 **(AERE-R—12056) Dismantling of the one-third-scale Joule ceramic melter and preliminary investigation of electrode corrosion.** Morris, J.B.; Walmsley, D.; Hollinrake, A.; Horsley, G. (UKAEA Atomic Energy Research Establishment, Harwell. Chemical Engineering Div.; UKAEA Atomic Energy Research Establishment, Harwell. Materials Development Div.). Jan 1986. 38p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88750794/JAW.

The Harwell one-third scale Joule ceramic melter was dismantled to discover the cause of a fall in electric resistance. The two inconel-690 electrodes were corroded over the lower 40mm sections and were examined by optical and electron microscopy. Sedimentation of Ru species on the floor of the melter may have led to corrosion of the electrodes. Glass withdrawn from the canisters was analyzed for evidence of a segregation mechanism.

8533 **(AERE-R—12064) Natural analogues for radioactive waste burial: a modelling perspective.** Hodgkinson, D.P.; Lever, D.A. (UKAEA Atomic Energy Research Establishment, Harwell. Theoretical Physics Div.). Dec 1985. 15p. (CONF-8511250—). H.M. Stationery Office, London, price Pound 4.00.

From 1. meeting of the natural analogue working group; Brussels, Belgium (5 Nov 1985).

The paper discusses some possible uses of natural analogues in repository safety assessment studies, from the point of view of those involved with the development and use of mathematical models. The characteristics of models used for performance assessment and for analysing experiments are outlined in order to address the question of to what extent natural analogues can be used to validate models. The safety case for burying cemented intermediate level waste in deep geological formations is outlined and the most critical processes and parameters are identified. (Natural analogues have the potential to provide useful information about some of these, especially long-term chemical processes in the geosphere. There is likely to be considerable uncertainty and ambiguity associated with the interpretation of natural analogues and thus it is their general features which should be emphasized, and models with appropriate levels of sophistication should be used.

8534 **(AERE-R—12124) Diffusion and sorption of Cs, Sr and I in water-saturated cement.** Atkinson, A.; Nickerson, A.K. (UKAEA Atomic Energy Research Establishment, Harwell. Materials Development Div.). Jan 1986. 33p. H.M. Stationery Office, London, price Pound 5.00.

Diffusion and sorption in cementitious materials are important factors influencing radionuclide migration in radioactive waste disposal. Four different experimental techniques have been used to study these processes for Cs^{+}, Sr^{2+} and I^{-} ions in Sulphate Resisting Portland Cement paste saturated with water. The results of different experimental methods are compared and their relative merits discussed. When factors concerning transport in porous media are taken into account, the present observations are also found to be compatible with the results of other studies. The most appropriate values of characteristic parameters for diffusion and sorption in this system are deduced.

8535 **(AERE-R—12155) Review of non-destructive techniques for the quality checking of encapsulated radioactive waste: ultrasonic methods.** Saunderson, D.H. (UKAEA Atomic Energy Research Establishment, Harwell. Materials Physics and Metallurgy Div.). Nov 1985. 19p. H.M. Stationery Office, London, price Pound 4.00.

This report reviews possible ultrasonic methods for quality checking cementitious monoliths containing intermediate level wastes. Some of the waste types will produce fine-grained cements favourable to ultrasonic propagation, but the steel drum encapsulating the monolith presents problems for the application of ultrasound. In general, it is concluded that there are few immediate uses for ultrasonic methods for quality checking other than monitoring the setting and hardening phases after casting.

8536 **(AERE-R—12203) Feasibility of sampling the glass pour in a high level waste vitrification plant.** Cole, G.V.; Shilton, P.; Morris, J.B. (UKAEA Atomic Energy Research Establishment, Harwell. Engineering Projects Div.). Jun 1986. 39p. H.M. Stationery Office, London, price Pound 5.00.

Vitrified high level waste can be sampled for quality assurance purposes in three general ways: (I) from the glass pour, (II) from the canister, and (III) from the melter. A discussion of the potential advantages and disadvantages of each route is presented. The second philosophy seems to show the best promise; it is recommended that the Contained Pot method and the Token method are best suited for further development. An international survey of policy at vitrification plants shows that with one possible exception no glass sampling is intended and that quality is normally to be assured by control of the vitrification process.

8537 **(ANS-R—604-4) Long-term storage of radioactive solid waste within disposal facilities.** Wakerley, M.W.; Edmunds, J. (Associated Nuclear Services, Epsom (UK)). May 1986. 95p. NTIS (US Sales Only), PC A05/MF A01. Order Number DE88750749/JAW.

A study of the feasibility and implications of operating potential disposal facilities for low and intermediate level solid radioactive waste in a retrievable storage mode for extended periods of up to 200 years has been carried out. The arisings of conditioned UK radioactive waste up to the year 2030 have been examined. Assignments of these wastes to different types of underground disposal facilities have been made on the basis of their present activity and that which they will have in 200 years time. Five illustrative disposal concepts proposed both in the UK and overseas have been examined with a view to their suitability for adaption for storage/disposal duty. Two concepts have been judged unsuitable because either the waste form or the repository structure were considered unlikely to last the storage phase. Three of the concepts would be feasible from a construction and operational viewpoint. This suggests that with appropriate allowance for geological aspects and good repository and waste form design that storage/disposal within the same facility is achievable. The overall cost of the storage/disposal concepts is in general less than that for separate surface storage followed by land disposal, but more than that for direct disposal.

8538 **(BMI/ONWI—657-Vol.1) Deposition of Cretaceous and Tertiary sediments in the eastern Mississippi Salt Basin (with emphasis on the Richton Dome area): Volume 1.** (Earth Technology Corp., Long Beach, CA (USA); Battelle Memorial Inst., Columbus, OH (USA). Office of Nuclear Waste Isolation). Aug 1987. Contract AC02-87CH10290;AC02-83CH10140. 266p. NTIS, PC A12/MF A01; 1; GPO Dep. Order Number DE88002186/JAW.

Regional structure-contour and isochore maps were constructed for selected Cretaceous and Tertiary lithostratigraphic units in the eastern half of the basin. Analysis of the isochore maps suggests that 70 to 80% of the sediment deposited within the basin during the Cretaceous Period was accompanied by subsidence of the continental margin; the remaining 20 to 30% was accompanied by subsidence of the Mississippi Salt Basin. As the continental margin reached isostatic equilibrium during the Tertiary, less sediment was deposited and thus was accompanied by less regional subsidence. Maximum depositional rates occurred during periods of delta building, and minimum rates occurred during periods of shallow marine deposition. Structure-contour and isochore maps were also constructed for a 1400-mi^2 (3500-km^2) area in the vicinity of Richton Dome to illustrate the effects of local salt withdrawal on the sedimentation patterns. 75 refs., 53 figs., 7 tabs.

8539 **(BMI/ONWI—665) Results of an accelerated borehole closure testing program at Avery Island, Louisiana.** Stickney, R.G. (RE/SPEC, Inc., Rapid City, SD (USA)). Sep 1987. Contract AC02-87CH10290. 64p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE88003317/JAW.

This report presents the results of an accelerated borehole closure testing program conducted in the test facility in the Avery Island salt mine. The accelerated borehole closure tests provided

data on the thermomechanical response of domal salt when subjected to conditions similar to those expected in a high-level nuclear waste repository. The objective is to aid numerical methods used to predict the creep behavior of salt. 5 refs., 19 figs., 2 tabs.

8540 **(CAP-S—3097/TR/15) Testing of a method of importance sampling for use with SYVAC.** Dalrymple, G.J.; Prust, J.O.; Edwards, H.H. (CAP Scientific Ltd., London (UK)). Oct 1985. 46p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88750745/JAW.

The Importance Sampling Scheme is designed to concentrate sampling in the high dose region of the parameter space. A sensitivity analysis of an intitial case study is used to roughly define the high dose and risk region of the parameter space. By applying modified distribution to the individual parameter ranges it was possible to concentrate sampling in regions of the parameter range that lead to high doses and risks. Comparison of risk estimates and cumulative distribution functions of dose for an increasing number of runs of the SYVAC model indicated that the risk estimate had converged at 1200 Importance Sampling runs. Examination of a plot of risk in various dose bands supported this conclusion. It was clear that the random sampling had not achieved convergence at 400 runs.

8541 **(CAP-S—3097/TR/19) Final report on the acquisition of data for use in the probabilistic risk assessment of underground disposal of radioactive wastes.** Dalrymple, G.J.; Johnson, K.B.; Phillips, L.D. (CAP Scientific Ltd., London (UK)). Jan 1986. 83p. NTIS (US Sales Only), PC A05/MF A01. Order Number DE88750732/JAW.

A preliminary radiological assessment of a potential site for the disposal of radioactive wastes is likely to be based on a limited amount of measured data. Under these circumstances the parameter probability distributions required as input to the SYVAC model have to be obtained from the judgements of experts. This study examined the feasibility of using a formal, auditable technique for encoding probabilities from expert opinions. When a more detailed site investigation is carried out, site specific measured data will become available. The feasibility of using a Bayesian approach for incorporating this measured data into the subjective probability distributions supplied by experts was examined. Measured data on the hydrogeological properties of the site are likely to be spatially correlated. A brief study of the suitability of using the Kriging technique for modelling and quantifying spatial correlations was conducted. The use of Kriging models can be very expensive and a more detailed cost-benefit study is required. There are a very large number of combinations of future events (or scenarios) which may effect the transport of radionuclides from a repository site. Two techniques, event trees and influence diagrams, for categorising and quantifying scenarios were examined. The study concluded that event trees can become unmanageable when there are a large number of possible scenarios. It is recommended that influence diagrams can provide a practical solution to categorising and quantifying scenarios.

8542 **(CONF-870859—25) Assessing waste management systems using REGINALT software.** Meshkov, N.K.; Camasta, S.F.; Gilbert, T.L. (Argonne National Lab., IL (USA)). 1987. Contract W-31109-ENG-38. 16p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88003092/JAW.

From 9. annual low-level radioactive waste management program conference; Denver, CO, USA (25 Aug 1987).

This paper provides methods and procedures that will enable managers to review an entire waste management system from generation to disposal to assess its performance. The method develops an efficient and practical process for comparing costs, benefits, risks, and trade-offs at all stages of waste management. A model called REGINALT was recently developed at EG and G Idaho, Inc., to allow the commercial sector to analyze the various treatment and disposal options available for handling a wide variety of waste streams. This model is reviewed here with respect to its potential usefulness for assessing DOE waste management systems. The model is well designed and simple to use, and can easily be augmented to provide a vary useful tool for DOE waste managers. 23 refs., 2 figs.

8543 **(CONF-871038—7) The TRUEX [TRansUranium EXtraction] process and the management of liquid TRU [transuranic] waste.** Schulz, W.W.; Horwitz, E.P. (Westinghouse Hanford Co., Richland, WA (USA); Argonne National Lab., IL (USA)). 1987. Contract W-31109-ENG-38. 35p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88003046/JAW.

From 5. symposium on separation science and technology for energy application; Knoxville, TN, USA (26 Oct 1987).

The TRUEX process is a new generic liquid-liquid extraction process for removal of all actinides from acidic nitrate or chloride nuclear waste solutions. Because of its high efficiency and great flexibility, the TRUEX process appears destined to be widely used in the US and possibly in other countries for cost-effective management and disposal of transuranic (TRU) wastes. In the US, TRU wastes are those that contain $\geqq 3.7 \times 10^6$ Bq/kg) of TRU elements with half-lives greater than 20 y. This paper gives a brief review of the relevant chemistry and summarizes the current status of development and deployment of the TRUEX (TRansUranium EXtraction) process flowsheets to treat specific acidic waste solutions at several US Department of Energy sites. 19 refs., 4 figs., 4 tabs.

8544 **(CONF-871075—23) ORNL liquid low-level waste solidification.** Schultz, R.M.; Monk, T.H.; du Mont, S.P.; Helms, R.E.; Keigan, M.V.; Morris, M.I. (Oak Ridge National Lab., TN (USA)). 1987. Contract AC05-84OR21400. 22p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88001766/JAW.

From 3. Oak Ridge model conference on waste problems; Oak Ridge, TN, USA (13 Oct 1987).

The solidification of LLLW at ORNL has developed two basic strategies, a near-term or backup flowsheet is planned to alleviate the immediate capacity problem for storage of concentrated LLLW and a long-term or reference flowsheet is planned to incorporate filtration of the settleable TRU and cesium and strontium decontamination of the LLLW. Presently a feasibility study is evaluating the process alternatives for segregating LLLW from remote-handled transuranic (RH-TRU) sludges, decontamination of the LLLW for beta-gamma radionuclides such as cesium and strontium, and the handling and storage of the RH-TRU sludges and decontamination media. 14 refs.

8545 **(DOE/CH/46656—03) Utility service entrance in boreholes.** (Morrison-Knudsen Engineers, Inc., San Francisco, CA (USA); Fluor Technology, Inc., Irvine, CA (USA)). Aug 1987. Contract AC02-83WM46656;AC02-83CH10140;AC02-87CH10290. 79p. NTIS, PC A05. Order Number DE88002494/JAW.

This study evaluates alternatives for utility service entrances to the repository. We determined the requirements for a repository utility supply. These requirements were defined as safety, maintainability, flexibility, reliability, cost efficiency, voltage regulation, and simplicity of operation. The study showed that repository shafts can best satisfy all requirements for location of the utility supply without the use of borehole penetrations into the repository. It is recommended that the shafts be utilized for utility distribution to the repository, and that the current NWTS program position to minimize the number of boreholes penetrating the repository horizon be maintained. 42 refs., 2 figs., 3 tabs.

8546 **(DOE/CH/46656—08) Shaft siting decision.** (Fluor Technology, Inc., Irvine, CA (USA)). Aug 1987. Contract AC02-83WM46656;AC02-87CH10290;AC02-83CH10140. 103p. NTIS, PC A06/MF A01; 1; GPO Dep. Order Number DE88002491/JAW.

This study identifies and establishes relative guidelines to be used for siting of repository shafts. Weights were determined for the significant factors that impact the selection of shaft locations for a nuclear waste repository in salt. The study identified a total of 45 factors. A panel of experienced mining people utilized the Kepner-Tregoe (K-T) Decision Analysis Process to perform a structured evaluation of each significant shaft siting factor. The evaluation determined that 22 of the factors were absolute constraints and that the other 23 factors were desirable characteristics. The group estab-

lished the relative weights for each of the 23 desirable characteristics by using a paired comparison method. 8 refs., 2 figs., 5 tabs.

8547 **(DOE/CH/46656—09) Rock mechanics models evaluation report.** (Fluor Technology, Inc., Irvine, CA (USA)). Aug 1987. Contract AC02-83WM46656;AC02-87CH10290;AC02-83CH10140. 159p. NTIS, PC A08/MF A01; 1; GPO Dep. Order Number DE88002490/JAW.

This report documents the evaluation of the thermal and thermomechanical models and codes for repository subsurface design and for design constraint analysis. The evaluation was based on a survey of the thermal and thermomechanical codes and models that are applicable to subsurface design, followed by a Kepner-Tregoe (KT) structured decision analysis of the codes and models. The primary recommendations of the analysis are that the DOT code be used for two-dimensional thermal analysis and that the STEALTH and HEATING 5/6 codes be used for three-dimensional and complicated two-dimensional thermal analysis. STEALTH and SPECTROM 32 are recommended for thermomechanical analyses. The other evaluated codes should be considered for use in certain applications. A separate review of salt creep models indicate that the commonly used exponential time law model is appropriate for use in repository design studies. 38 refs., 1 fig., 7 tabs.

8548 **(DOE/CH/46656—10) Exploratory Shaft Facility quality assurance impact evaluation.** (Fluor Technology, Inc., Irvine, CA (USA)). Aug 1987. Contract AC02-83CH10140;AC02-87CH10290;AC02-83WM46656. 144p. NTIS, PC A07. Order Number DE88002489/JAW.

This report addresses the impact of the quality assurance practices used for the Exploratory Shaft Facility (ESF) design, and construction in licensing as part of the repository. Acceptance criteria used for evaluating the suitability of ESF QA practices are based on documents that had not been invoked for repository design or construction activities at the time of this evaluation. This report identifies the QA practices necessary for ESF design and construction licensability. A review and evaluation of QA practices for ESF design and construction resulted in the following conclusions. QA practices were found to be acceptable with a few exceptions. QA practices for construction activities were found to be insufficiently documented in implementing procedures to allow a full and effective evaluation for licensing purposes. Recommendations are provided for mitigating impacts to ensure compatibility of the QA practices with those considered necessary for repository licensing. 8 refs., 3 tabs.

8549 **(DOE/HWP—30) The Los Alamos controlled air incinerator for radioactive waste: Volume 3, Modifications for processing hazardous chemicals and mixed wastes.** Koenig, R.A.; Borduin, L.C.; Hutchins, D.A.; Vavruska, J.S.; Warner, C.L. (Los Alamos National Lab., NM (USA)). Oct 1987. Contract W-7405-ENG-36. 45p. (LA—9427-Vol.3). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88001950/JAW.

This report describes the design and operation of the Los Alamos National Laboratory Controlled Air Incinerator (CAI). This third volume addresses categories of information that pertain to modifications to the CAI in the period between 1981 and 1986. These later system changes were motivated by programmatic objectives to use the CAI for additionally studying combustion of low-level radioactive wastes and hazardous chemicals. 19 figs., 13 tabs.

8550 **(DOE/HWP—41) Waste acid detoxification and reclamation: Summary of bench-scale tests for FY 1986 and FY 1987.** Stewart, T.L. (Pacific Northwest Lab., Richland, WA (USA)). Sep 1987. Contract AC05-84OR21400;AC06-76RL01830. 58p. (PNL—6321). NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE88001452/JAW.

Processes to reduce the volume, quantity, and toxicity of metal-bearing waste acid are being demonstrated at Pacific Northwest Laboratory. Two precipitation processes and a distillation process are being developed to minimize waste from fuel fabrication operations, which comprise a series of metal-finishing operations. Waste process acids such as HF-HNO_3, etch solutions containing Zr as a major metal impurity, and HNO_3 strip solution containing Cu as a major metal impurity are detoxified and reclaimed by concurrently precipitating heavy metals and regenerating acid for recycle. Acid from a third waste acid stream generated from chemical milling operations will be reclaimed using distillation. This stream comprises HNO_3 and H_2SO_4 containing U as the major metal impurity. Distillation allows NO_3^- to be displaced by SO_4^{-2} in metal salts; free HNO_3 is then vaporized from the U-bearing sulfate stream. Uranium can be recovered from the sulfate stream in a downstream precipitation step. 10 refs., 15 figs., 13 tabs.

8551 **(DOE/NE/44139—37) Spent nuclear fuel removal program at the West Valley Demonstration Project: Topical report.** Connors, B.J.; Golden, M.P.; Valenti, P.J.; Winkel, J.J. (West Valley Nuclear Services Co., Inc., West Valley, NY (USA)). Mar 1987. Contract AC07-81NE44139. 81p. NTIS, PC A05/MF A01; 1; GPO Dep. Order Number DE88002634/JAW.

The spent nuclear fuel removal program at the West Valley Demonstration Project (WVDP) consisted of removing the spent nuclear fuel (SNF) assemblies from the storage pool in the plant, loading them in shielded casks, and preparing the casks for transportation. So far, four fuel removal campaigns have been completed with the return of 625 spent nuclear fuel assemblies to their four utility owners. A fifth campaign, which is not yet completed, will transfer the remaining 125 fuel assemblies to a government site in Idaho. A spent fuel rod consolidation demonstration has been completed, and the storage canisters and their racks are being removed from the fuel receiving and storage pool to make way for installation of the size reduction equipment. A brief history of the West Valley reprocessing plant and the events leading to the storage and ownership of the spent nuclear fuel assemblies and their subsequent removal from West Valley are also recorded as background information. 3 refs., 16 figs., 9 tabs.

8552 **(DOE/NE/44139—41) Decontamination and decommissioning of the Chemical Process Cell (CPC): Topical report for the period January 1985-March 1987.** Meigs, R.A. (West Valley Nuclear Services Co., Inc., West Valley, NY (USA)). Jul 1987. Contract AC07-81NE44139. 55p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE88002431/JAW.

To support interim storage of vitrified High-Level Waste (HLW) at the West Valley Demonstration Project, the shielded, remotely operated Chemical Process Cell (CPC) was decommissioned and decontaminated. All equipment was removed, packaged and stored for future size reduction and decontamination. Floor debris was sampled, characterized, and vacuumed into remotely handled containers. The cell walls, ceiling, and floor were decontaminated. Three 20 Mg (22.5 ton) concrete neutron absorber cores were cut with a high-pressure water/abrasive jet cutting system and packaged for disposal. All operations were performed remotely using two overhead bridge cranes which included two 1.8 Mg (2 ton) hoists, one 14.5 Mg (16 ton) hoist, and an electromechanical manipulator or an industrial robot mounted on a mobile platform. Initial general area dose rates in the cell ranged from 1 to 50 R/h. Target levels of less than 10 mR/h general area readings were established before decontamination and decommissioning was initiated; general area dose rates between 200 mR/h and 1200 mR/h were obtained at the completion of the decontamination work. 4 refs., 11 figs., 8 tabs.

8553 **(DOE/RW—0145-1) [Office of Civilian Radioactive Waste Management] Quarterly report on program cost and schedule: Third quarter, FY 1987.** (USDOE Office of Civilian Radioactive Waste Management, Washington, DC). 1987. 40p. Civilian Radioactive Waste Management, US Dept. of Energy, RW-40, Washington, DC 20585. Order Number TI88001959/JAW.

This report is intended to provide a summary of the cost and schedule performance for the civilian radioactive waste management program. Performance data are presented for each of the major program elements. Also included is the status of the Nuclear Waste Fund revenues and disbursements. 22 figs.

8554 **(DOE/RW—0152) Answers to your questions on high-level nuclear waste.** (USDOE Office of Civilian Radioactive Waste Management, Washington, DC). Nov 1987. 61p. Civilian Radioactive Waste Management, US DOE RW-40, Washington, DC 20585. Order Number TI88002089/JAW.

This booklet contains answers to frequently asked questions about high-level nuclear wastes. Written for the layperson, the document contains basic information on the hazards of radiation, the Nuclear Waste Management Program, the proposed geologic repository, the proposed monitored retrievable storage facility, risk assessment, and public participation in the program. (TEM)

8555 **(DP-MS—87-82) Summary of environmental impacts and costs for waste site closure options at the Savannah River Plant.** Johnson, W.F.; Moyer, R.A. (Savannah River Lab., Aiken, SC (USA); Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Plant). 1987. Contract AC09-76SR00001. 11p. (CONF-870859—7). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE87014433/JAW.

From 9. annual low-level radioactive waste management program conference; Denver, CO, USA (25 Aug 1987).

The postulated closure options considered for this analysis include waste removal and closure, no waste removal and closure, and no action. In addition, an analysis of the project costs for each closure option at each waste site was performed. To assess the impacts of these waste management activities, modeling of contaminant transport in the environmental media and calculations of health risk at specified receptors were performed. It is necessary to quantify the presence of hazardous constituents, evaluate the environmental transport pathways and routes of exposure, and then estimate the relative risk associated with the exposure. Computer modeling was performed to assess contaminant migration, fate, exposure, and risk through surface, subsurface, and atmospheric environmental pathways. There was a simulation model or group of models used to calculate the transport and concentrations, determine dose, and estimate health effects for each of the pathways analyzed. The computer codes used in the multiple pathway analysis range from analytical solutions to the more complex numerical methods; however, all modeling methods represent an approximation of the real physical system based on simplifying assumptions. 8 refs., 4 tabs.

8556 **(EGG-WM—6877) Guidance manual for hazardous and radioactive mixed waste.** (EG and G Idaho, Inc., Idaho Falls (USA)). Sep 1985. Contract AC07-76ID01570. 242p. NTIS, PC A11/MF A01; 1; GPO Dep. Order Number DE88002203/JAW.

The purpose of this manual is to provide general operational guidance to operators of DOE-ID facilities on how to conduct various aspects of their waste management programs. The manual contains active hazardous waste site activities, inactive hazardous waste site activities, polychlorinated biphenyl (PCB) waste disposal activities, asbestos waste disposal activities, and radioactive mixed waste activities. Section 1 discusses the purpose, scope, and applicability of the manual, provides background information, and describes the goals of the hazardous and radioactive mixed waste programs. Responsibilities and authorities for hazardous and radioactive mixed waste management at DOE-ID facilities are discussed in Section 2. The various documents that are required to establish and maintain an adequate hazardous and radioactive mixed waste management program are described in Section 3. Hazardous waste activities regulated by the Environmental Protection Agency (EPA) are discussed in Sections 4 through 7, respectively. Section 8 describes the control of radioactive mixed waste activities. 33 refs., 3 figs., 17 tabs.

8557 **(EGG-WM—7802) Preliminary safety analysis report for the Decontamination and Decommissioning of the ARVFS [Army Reentry Vehicle Facility Site] NaK.** Mobley, E.V. (EG and G Idaho, Inc., Idaho Falls (USA)). Sep 1987. Contract AC07-76ID01570. 79p. NTIS, PC A05/MF A01; 1; GPO Dep. Order Number DE88002198/JAW.

This document presents the safety analysis for the Decontamination and Decommissioning (D and D) of the contaminated NaK (sodium-potassium) eutectic solution stored at the Army Reentry Vehicle Facility Site (ARVFS). The D and D activity of processing NaK has been planned and designed to meet appropriate safety standards. A plan to process four containers of contaminated NaK eutectic solution (180 gallons of liquid metal), including transuranics, into a waste form acceptable for disposal has been developed. The NaK is stored in two 55-gallon drums and two vessels fabricated from pipe sections. The containers have been stored in an underground bunker at the ARVFS located near the center of the Idaho National Engineering Laboratory (INEL). 9 refs., 7 figs., 5 tabs.

8558 **(ENPU—82-11) Swelling properties of the mudrocks at Harwell.** Hobbs, P.R.N.; Yeow, H.; Horseman, S.T.; Jackson, P.D. (Institute of Geological Sciences, Harwell (UK). Environmental Protection Unit). Dec 1982. 64p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE88750729/JAW.

Swelling and swelling pressure have an impact in areas of repository engineering in the context of radioactive waste disposal in clay. This report presents and assesses the results of a preliminary study on the swelling of mudrock cores from Harwell boreholes HW3 and HW4. Apparatus has been developed for a one-dimensional pressure test. Supplementary tests included free-swell tests, and the determination of dry density, natural moisture content, linear shrinkage and Atterberg consistency limits. Minerological details of test materials are also given. (U.K.).

8559 **(EUR—29) Disposal of nuclear waste at sea - a review of development and industrial opportunities.** Spagni, D.A.; Cameron, H.M.; Ford, G.J. (UEG, London (UK)). 1986. 106p. UEG, 6 Storey's Gate, Westminster, London SW1P 3AU, price Pound 40 (Pound 8 to UEG members).

The future of nuclear power in many countries depends on the nuclear industry demonstrating that waste generated can be disposed of in an acceptable way. Industrial firms taking an early lead in this field are assured of a world-wide market. Large scale investment will be needed to establish an ocean disposal system and will involve the development of new port facilities, the design and construction of purpose built ships, corrosion resistant canisters and geotechnical surveys to investigate and select suitable disposal sites. The UK could play a leading role in the development of such commercial ventures.

8560 **(EUR—10509(v.2)) Simulation of the life of a radioactive waste repository at different stages of its evolution. Volume 2: influence of the thermal loading.** Goblet, P. (Ecole des Mines, 77 - Fontainebleau, France). (Commission of the European Communities, Luxembourg). 1986. 121p. (In French). NTIS (US Sales Only), PC A06/MF A01. Order Number DE88751580/JAW.

The purpose of this study is to assess the modification of the flow pattern inside a granitic rock mass due to the thermal loading created by a radioactive waste repository. Data collected on the french site of Auriat are used for simulations with the numerical code METIS. The natural medium is represented by a vertical cross section covering several kilometers and integrating major inlets and outlets. The model describes the coupled flow and heat movement. Three possible geometries of the repository are envisaged corresponding to a more or less compact arrangement of the canisters and to different durations of preliminary storage. For the reference values of the parameters as well as for realistic variations, the heat transfer is shown to be indepedent of the flow, which in turn is feebly modified by the temperature rise. The thermal phase extends on a period of 10000 years approximately, with a maximum temperature increase of about 120 degrees. The behaviour of a source diluted in the total volume containing the repository is compared with a refined local model. The discrepancy between the two models vanishes after 100 years. An optimum discretization of the repository zone is defined by comparison to analytical solutions. Finally, the continuous medium model is compared to a double medium model describing the role of the fractures. The continuous model is shown to be satisfactorily for the range of parameters characteristic of the Auriat site.

8561 **(EUR—10737) Measurements in the 300-metre deep dry-drilled borehole and feasibility study on the dry-drilling of a 600-metre deep borehole in the Asse II salt-mine.** Prij, J.; Jansen, D.; Klerks, W.; Luyten, G.B.; Ruiter De, A.; Vons, L.H. (Netherlands Energy Research Foundation, Petten). (Commission of the European Communities, Luxembourg). 1986. 260p. NTIS (US Sales Only), PC A12/MF A01. Order Number DE88751585/JAW.

In 1980 a borehole with a diameter of 300 millimetres and a depth of 300 metres was drilled with a dry-drilling technique in the Asse II salt-mine in the Federal Republic of Germany. This borehole was used to perform a series of in-situ experiments to establish the constitutive behaviour of rock-salt, to measure the temperature-induced compression on a heated tube and to validate the computer codes for the thermo-mechanical behaviour. Three types of experiments are performed and described in this report: free isothermal convergence measurements; temperature-induced pressure measurements; free non-isothermal convergence measurements. It is shown that the thermo-mechanical behaviour of rock-salt can be described accurately with a set of constitutive equations based upon elastic behaviour and secondary creep. It is measured that the state of stress at a depth of 830 metres deviates significantly from the lithostatic pressure. This deviation is shown to be caused by the stress redistribution due to the large excavations in the mine. The maximum compression on a heated tube is measured to be about 35 MPa for a lithostatic pressure of 17 MPa and a maximum salt temperature of 175/sup O/C. In this report the results are given of a feasibility study on the dry drilling of a 600 metre deep borehole in Asse II. This study is based on the classic roller-bit configuration. Parallel, the GSF has developed a more advanced drilling technique, which will be pursued for the 600 metre hole experiment. The study under consideration must therefore be seen as a "backing up solution" in the improbable situation that the advanced GSF system will not fulfil its promises.

8562 **(EUR—10785) Mechanisms of sorption of neptunium and technetium on argillaceous materials.** Hooker, P.J.; West, J.M.; Noy, D.J. (British Geological Survey, Keyworth, UK). (Commission of the European Communities, Luxembourg). 1986. 23p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88751588/JAW.

It is of pressing concern to understand the behaviour of radionuclides in the environment and in particular long-lived ones (e.g. Np-237 and Te-99) in argillaceous rocks. Clay formations have been chosen as likely candidates for holding low level radioactive waste repositories and in the event of leakage of radionuclides into the geosphere some knowledge of their fate is required in a far-field safety assessment study. The objectives of this present work were to examine the properties of neptunium and technetium in groundwaters associated with clay-rich materials and to ascertain the variations in sorption of these radionuclides under different environmental conditions and to use the information in a forecast of transport through a clay layer.

8563 **(EUR—10787(v.1)) Sealing of exploratory boreholes in clay reactivity of ordinary portland cement (OPC) grouts and various lithologies from the Harwell research site. Volume 1.** Milodowski, A.E.; George, I.A.; Bloodworth, A.J.; Robins, N.S. (British Geological Survey, Keyworth, UK). (Commission of the European Communities, Luxembourg). 1986. 46p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88751589/JAW.

As part of a research programme on the disposal of radioactive wastes in clay, Ordinary Portland Cement (OPC) has been used in the completion of boreholes on the Harwell Research Site, AERE, Oxfordshire. The purpose of this study was to examine the effect of OPC and the alkaline pore fluids generated during its setting on the various lithological types encountered in the boreholes. To facilitate this, samples of core representing the various rock types were selected and cement-rock composites were prepared from these in the laboratory to simulate the borehole cements. After a curing period of 15 months the cores and associated cement plugs were examined for any signs of reactivity or bonding. The best cement-rock bonding was shown by naturally well-cemented sandstone and limestone lithologies. Although no significant chemical reaction was seen to have occurred between OPC and rock, the OPC appears able to bind onto the rock surface because of the rigidity of the rock surface. Therefore, the best cement rock bonding and seal with OPC may be expected in the limestones of the Great Oolite Group, Inferior Oolite Group and parts of the Corallian beds. Because of the reactivity of OPC towards certain lithologies a better borehole seal in such a sedimentary sequence might be achieved using a bentonite backfill in those parts of the sequence which either react with or bond only weakly to OPC.

8564 **(EUR—10787(v.2)) Sealing of exploratory boreholes in clay. The assessment of borehole cement sealing characteristics by acoustic waveform analysis. Volume 2.** Brereton, N.R.; Brightman, M.A. (British Geological Survey, Keyworth, UK). (Commission of the European Communities, Luxembourg). 1986. 112p. NTIS (US Sales Only), PC A06/MF A01. Order Number DE88751590/JAW.

As part of a research programme on the disposal of radioactive wastes in clay, acoustic waveform analysis was used to evaluate the effectiveness of cement bonding for sealing three boreholes drilled at Harwell. The results from this study indicate that the bonding at both the cement/casing and, more importantly, the cement/formation interfaces would almost certainly be inadequate for the purposes of sealing a radioactive waste repository. The use of an alternative backfill material such as bentonite is advocated.

8565 **(EUR—10851) Performance of non-parametric statistics in sensitivity analysis and parameter ranking.** Saltelli, A.; Marivoet, J. (Commission of the European Communities, Ispra, Italy. Joint Research Centre; SCK-CEN, Mol,, Belgium). (Commission of the European Communities, Luxembourg). 1987. 60p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE88751596/JAW.

Twelve parametric and non-parametric sensitivity analysis techniques are compared in the case of non-linear model responses. The test models used are taken from the long-term risk analysis for the disposal of high level radioactive waste in a geological formation. They describe the transport of radionuclides through a set of engineered and natural barriers from the repository to the biosphere and to man. The output data from these models are the dose rates affecting the maximum exposed individual of a critical group at a given point in time. All the techniques are applied to the output from the same Monte Carlo simulations, where a modified version of Latin Hypercube method is used for the sample selection. Hypothesis testing is systematically applied to quantify the degree of confidence in the results given by the various sensitivity estimators. The estimators are ranked according to their robustness and stability, on the basis of two test cases. The conclusions are that no estimator can be considered the best from all points of view and recommend the use of more than just one estimator in sensitivity analysis.

8566 **(EUR—10857) Acoustic P-wave velocity measurements of cataclastic effects in rock salt.** Roest, J.P.A. (Delft Univ., Netherlands). (Commission of the European Communities, Luxembourg). 1987. 51p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE88751597/JAW.

Model tests are carried out, in order to investigate the cataclastic thermo-mechanical behaviour of rock salt around a simulated repository borehole. The measurements are performed during a transient period of heating and subsequent cooling. Acoustic cross-hole measurements are carried out under conditions of compression, scale 1: 41/2. The relationship between cataclastic effects and the acoustic velocity differences is described. Macrofracturing only occurred under circumstances of cooling, when a heater was switched off. One of the model tests was used in the CEC benchmark exercise "COSA". Acoustic measuring tubes have been developed for the in situ research on structural changes in rock salt. The tests involved the performance of so-called hole measurements in two parallel boreholes, containing the measuring tubes. The most important observations of a test in an old room in the Asse Mine are the following. A bifurcating open fissure, about 6 to 8 mm wide, prevented the propagation of the acoustic wave; this demonstrates that such cracks and fissures are easily detectable by the applied method. The microcataclasis, particularly that near the room-

side wall, causes a reduction of the acoustic velocities, the more so as the angle between the measuring direction and the roomside wall increases. During the injection of a gallery wall with epoxy resins (by GSF) acoustic crosshole measurements were carried out as well. A detailed picture was obtained of the process of the closing of the fractures. By core drilling after this test confirmation was obtained that the fractures were closed. The information that has been gathered, will be used for the interpretation of the crosshole measurements in the near future; these measurements will be carried out around a heater borehole in the HAW field, a large underground test (GSF-ECN).

8567 **(EUR—10922) Study of hydrological and geochemical data on materials for the final cover of subsurface storage sites.** Sauter, M.; Barres, M.; Faby, J. (Commissariat a l'energie atomique, 75 - Paris, France. Agence nationale pour la gestion des dechets radioactifs). (Commission of the European Communities, Luxembourg). 1987. 121p. (In French). NTIS (US Sales Only), PC A06/MF A01. Order Number DE88751601/JAW.

The European Research program includes studies on highly watertight materials likely to sait the final cover of low-level and intermediate-level waste disposal. The experimental equipment is composed of a 26 sq. m collector placed on an inclined plane, just below the material to be tested and connected by means of a gutter with a measuring room where the infiltration waters flow rate is steadily measured. On the surface of the tumulus, a 300 sq.m inclined plane permits the measure of the running off water. The recording raingauge completes the device. Water vapour pressures are measured at different depths within the material. Total watercontents are registered along vertical profils using a special neutron logging tool. Numerous physico-chemical measures are carried out on the infiltration and running off waters: pH, Eh, temperature, dissolved oxygen, conductivity, turbidity and major anions and cations. Two materials have been tested with this device: - weathered schists; Compacted clay. The first material showed that, on average over the six months period of measurements, the overall rainfall brokedown into 11% running waters, 13% infiltration and 76% evaporation because infiltration accounts for a large part of rainfall. It resulted in a complete saturation of the material during certain periods of the year. Humidity measurements performed at different places pointed out large heterogeneities inside the material. It is worth noting that, despite some problems due to calibration, the whole instrumentation located in the measuring room worked rather well and permitted to demonstate the bad qualities of the material. The second material was subsequently covered by a 20 cm thick layer made of a mixture of sand in order to regularize water infiltration under the soil vegetation constituted by a special grass growing.

8568 **(EUR—10933) Geoprospective study of radioactive waste repositories applied to a paleosite.** Filippi, C.; Fourniguet, J.; Godefroy, P.; Manigault, B.; Peaudecerf, P. (Bureau de Recherches Geologiques et Minieres, 45 - Orleans, France). (Commission of the European Communities, Luxembourg). 1987. 75p. (In French). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88751602/JAW.

The aim of this research is to valid the geoprospective approach elaborated previously in the framework of contracts with Commission of European Communities. The geoprospective approach is applied to a "paleosite" i.e. to a region the evolution of which can be reconstructed for the last 100.000 years. This work is performed on a part of Parisian Basin near the English Channel coast. It allows to simulate the combined effects of sea and river level variations, and tectonic activity. All these factors taken in a rather severe context, would not have changed significantly, the confining conditions of the geological barrier around a radioactive waste repository.

8569 **(EWE-FWM—2552-B) Implications of long-term surface or near-surface storage of intermediate and low-level wastes in the UK.** Murray, N.; Vande Putte, D.; Ware, R.J. (Electrowatt Engineering Services Ltd., Horsham (UK)). Feb 1986. 89p. NTIS (US Sales Only), PC A05/MF A01. Order Number DE88750679/JAW.

Various options for 200 year-long storage of all Low- and Intermediate-Level wastes generated to the year 2030 are considered. On-site storage and centralised storage have been examined and compared. The feasibility of storing some of the wastes in underground facilities that are convertible to repositories has been demonstrated, but it is shown that centralised, surface storage of wastes would be more economical. There appears to be little merit in storing Intermediate Level wastes in separate facilities that could be converted to repositories. Storage is shown to be more expensive than direct disposal, except if future costs are discounted by more than about 10%. With carefully designed stores and remote handling, the collective dose to operators could be limited to about 20-40 man Sv over the whole period of storage.

8570 **(EWE-TR—4) Influence of geological loading on the structural integrity of an underground nuclear waste repository.** Jakeman, N. (Electrowatt Engineering Services Ltd., Horsham (UK)). Aug 1985. 120p. NTIS (US Sales Only), PC A06/MF A01. Order Number DE88750734/JAW.

Stresses are developed in underground nuclear waste repositories as a result of applied loads from geological movements caused by the encroachment of ice sheets or seismic activity for example. These stresses may induce fracturing of the waste matrix, repository vault and nearfield host geology. This fracturing will enhance the advective flow and allow more-rapid transfer of radionuclides from their encapsulation through the repository barriers and nearfield host rock. Geological loads may be applied either gradually as in crustal folding or encroachment of ice sheets, or rapidly as in the case of seismic movements. The analysis outlined in this report is conducted with a view to including the effects of geological loading in a probabilistic repository site assessment computer code such as SYVAC.

8571 **(EWE-TR—5) Thermal analysis of low heat generating radioactive wastes in land disposal facilities.** Lympany, S.D. (Electrowatt Engineering Services Ltd., Horsham (UK)). Aug 1984. 87p. NTIS (US Sales Only), PC A05/MF A01. Order Number DE88750733/JAW.

A procedure is developed which allows a simple thermal analysis of a radioactive waste repository. The procedure is used to establish if the thermally induced groundwater flow is important when considering the transport of radionuclides from the repository, and thereby indicates if this flow should be taken into account in a detailed thermal assessment.

8572 **(EWE-TR—6) Verification of vault model 'VERMIN' for post closure behaviour of repositories for non-heat generating radioactive wastes.** Oldfield, S.G. (Electrowatt Engineering Services Ltd., Horsham (UK)). Jan 1986. 95p. NTIS (US Sales Only), PC A05/MF A01. Order Number DE88750735/JAW.

The computer program VERMIN embodies a generalised model of a nuclear waste repository suitable for LAND2 or LAND3 types of disposal site. This model is designed for use within the probabilistic assessment code SYVAC. VERMIN is intended to represent the nearfield flow and transport processes, and communicates with the far field geosphere and biosphere models within SYVAC. This document gives details of the verification tests applied to the VERMIN computer model. The tests given are a subset of the full program testing carried out during its development up to September, 1985. Tests are chosen to demonstrate that both the individual processes modelled within VERMIN, and also the overall model itself performs as it would be expected and that the program gives realistic predictions of radionuclide releases from the repository vault.

8573 **(FLPU—83-11) Geophysical logging of the Harwell boreholes.** Brightman, M.A. (British Geological Survey, Keyworth. Fluid Processes Research Group). Aug 1983. 105p. NTIS (US Sales Only), PC A06/MF A01. Order Number DE88750800/JAW.

A comprehensive geophysical borehole logging survey was carried out on each of three deep boreholes drilled at the Harwell research site. KOALA and PETRA computer programs were used

to analyse and interpret the logs to obtain continuous quantitative estimates of the geological and hydrogeological properties of the sequences penetrated at the Harwell site. Quantitative estimates of the mineral composition and porosity of the cores samples were made.

8574 **(FLPU—84-7) Hydrogeological investigations in the Harwell region: the use of environmental isotopes, inert gas contents, and the uranium decay series.** Alexander, J.; Andrews, J.N. (British Geological Survey, Keyworth. Fluid Processes Research Group). Dec 1984. 40p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88750805/JAW.

A comprehensive range of environmental isotopes, radioelement and dissolved gas contents have been measured in groundwaters from the high permeability formations of the Harwell area. These analyses were undertaken as part of a hydrochemical validation of groundwater circulation patterns derived from potentiometric data. These investigations have focused upon the Corallian and Great Oolite formations since these sandwich the Oxford Clay. Geochemical, isotopic, radioelement and inert gas studies have demonstrated consistent trends which substantiate fluid migration patterns derived from hydraulic considerations. Groundwaters at downdip localities in both the Corallian and Great Oolite formations are the oldest waters sampled from the region. Variations in trends in parameters can be attributed to cross-formational flow and subsequent mixing of groundwaters. Individually these techniques can only provide limited information, but the combination of methods used have provided corroborative evidence concerning the direction of fluid circulation in the Harwell region.

8575 **(FLPU—85-6) Pore fluids from the argillaceous rocks of the Harwell region.** Brightman, M.A.; Bath, A.H.; Cave, M.R.; Darling, W.G. (British Geological Survey, Keyworth. Fluid Processes Research Group). Jun 1985. 77p. NTIS (US Sales Only), PC A05/MF A01. Order Number DE88750703/JAW.

The aim of this work was to obtain samples of pore water from argillaceous formations in the Harwell area for chemical analysis to provide a background for radionuclide migration studies and regional groundwater flow pattern. This report describes the samples, development of a pore-water squeezing cell and its operation. Chemical and analytical studies are summarized.

8576 **(FLPU—85-11) Long term effects on potential repository sites: climatic and geomorphological changes.** Seddon, M.B.; Worsley, P. (British Geological Survey, Keyworth. Fluid Processes Research Group). May 1985. 71p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE88750704/JAW.

A study of the effects of climatic variability on the geomorphological processes operating on the landscape are important in the study of radioactive waste repository sites. The effects of glacial erosion and deposition are fundamental to an examination of repository safety, particularly in North Britain. Rates of climatic shift need to be examined. Predictive simulation models, based on a knowledge of past climatic events, for future global climates are proposed.

8577 **(FLPU—86-1) Assessment of borehole cement sealing characteristics by acoustic waveform analysis.** Brereton, N.R.; Brightman, M.A. (British Geological Survey, Keyworth. Fluid Processes Research Group). Jan 1986. 96p. NTIS (US Sales Only), PC A05/MF A01. Order Number DE88750728/JAW.

Acoustic waveform analysis has been used to provide a quantitative analysis of the effectiveness of cement grouting for sealing three adjacent boreholes drilled at Harwell, Oxon, as part of a research programme into the disposal of radioactive wastes into argillaceous formations. Results indicate that bonding at cement/casing and cement/formation interfaces would be inadequate for sealing a radioactive waste repository and the use of a backfilling material such as bentonite is advocated. (U.K.).

8578 **(GESD—87-62) AECL-US/DOE radioactive waste management technical cooperation program, 1985-1989: Subsidiary Agreement Number 1: Quarterly report to 1987 September.** (Atomic Energy of Canada Ltd., Pinawa, Manitoba. Whiteshell Nuclear Research Establishment). Oct 1987. 28p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88002444/JAW.

Topics include site characterization, emplacement heating experiments, container experiments, borehole sealing tests, performance assessment studies, computer codes, field testing, drilling procedures, shaft development, project engineering, and funding. (TEM)

8579 **(GSF—33/86) Storage and solidification of MAW/LAW in underground cavities. Investigations on model caverns.** Fischle, W.R.; Schwieger, K.; Doerr, H.; Struth, R.; Herbert, H.J.; Raab, W.; Hauser, W. (Gesellschaft fuer Strahlen- und Umweltforschung m.b.H. Muenchen, Braunschweig (Germany, F.R.). Inst. fuer Tieflagerung). 1986. 84p. (In German). (GSF-T—255). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88751492/JAW.

The first part of the report reproduces the targets, the production of the test area and other preparatory work and the filling and measurement when introducing the waste/binder mixture into the model cavern. Three short parts on the arrangement of the cavern, investigations on loosening material from the caverns and the determination of the hydration heat data during storage form the second part.

8580 **(HN—10476-1141) Volume Reduction Research and Development Project (VORRP): Utilizing the TRUclean process: [Technical paper], September 2, 1986-September 30, 1987.** Sunderland, N.R. (AWC, Inc., Las Vegas, NV (USA)). 30 Sep 1987. Contract AC08-86NV10471. 23p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88002519/JAW.

This research was undertaken to determine if the AWC TRUclean process could remove radioactive contamination from differing soil matrices that were submitted by participating sites from around the nation. The TRUclean process removed plutonium from coral derived soil. Interest developed in applying the process to other radioactive contaminants and soil types. Soils from the Nevada Test Site (NTS); Rocky Flats Plant (RFP) in Colorado; FUSRAP site at Hazelwood, Missouri; Monsanto-Mound site in Ohio, and the Ft. Dix site in New Jersey were tested. The TRUclean process was able to effectively decontaminate soils and concentrate the contamination into a substantially smaller volume than the original soil. 14 refs., 6 figs.

8581 (IAEA-TECDOC—421, pp 97-106) **Glass melter materials: technical options for the French vitrification process and operating experience.** Bonniaud, R.; Demay, R.; Richter, R.; Rozand, L. (CEA, Institut de Recherche Technologique et de Developpement Industriel, Marcoule, France; CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92, France. Inst. de Recherche Technologique et de Developpement Industriel, IRDI; Societe Generale pour les Techniques Nouvelles S.G.N., 78 - Saint-Quentin-en-Yvelines, France; Cogema, Saint-Quentin en Yvelines, France). May 1987. NTIS (US Sales Only), PC A10/MF A01. Order Number DE88700614/JAW. (CONF-860987—).

From Technical committee on materials reliability in the back end of the nuclear fuel cycle; Vienna, Austria (2 Sep 1986).

The French vitrification process for solidifying high-level radioactive waste which has been under industrial application since 1978, is briefly mentioned. This technique involves glass melting at 1,150 deg. C, using an induction heated metallic vessel. The molten glass pouring is controlled by a thermal gate, which is also heated by induction. Two types of vessel are in use. Both are remotely removable and disposable to permit replacement at regular intervals. The technical criteria that the materials have to meet are described. The behaviour of the materials has been investigated using the industrial experience gained in the AVM facility during 8 years of operation, as well as with operation of a prototype for the new vit-

rification facilities under construction at La Hague. A short description of the use of these materials is also presented. 5 figs, 2 tabs.

8582 (INIS-GB—23) **EDRP public local inquiry, UKAEA/BNFL precognition on: EDRP waste management (excluding gaseous emissions).** Kenny, D.A. (UKAEA Headquarters, London; British Nuclear Fuels Ltd., Risley). Jan 1986. 40p. (DP—5). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88750740/JAW.

The management of radioactive wastes, produced as by-products of the operation of the proposed EDRP, is considered. The arisings of the various types of waste are discussed and an outline is presented of the research and development work being carried out in support of the management of the radioactive wastes. (U.K.).

8583 (INIS-GB—39) **[EDRP public local inquiry] radioactive waste management statement. Application by the United Kingdom Atomic Energy Authority and British Nuclear Fuels plc jointly for outline planning permission for the construction and operation of a European Demonstration Reprocessing Plant (EDRP) for fast reactor fuel.** (Scottish Development Dept., Edinburgh (UK). Her Majesty's Industrial Pollution Inspectorate). Mar 1986. 19p. (HMIPI-P—1). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88750802/JAW.

The statutory arrangements which will apply to the proposed EDRP at Dounreay in relation to radioactive waste management matters, and the principles against which it will be assessed, are described. Also included are some preliminary, provisional comments on the waste management implications of the outline application. (U.K.).

8584 (INIS-GB—42) **[EDRP public local inquiry] Radioactive waste management policy in the UK (with particular reference to Scotland) (Revised statement). Application by the United Kingdom Atomic Energy Authority and British Nuclear Fuels plc, jointly for outline planning permission for the construction and operation of a European Demonstration Reprocessing Plant (EDRP) for fast reactor fuel.** Robinson, R.E.S. (Scottish Development Dept., Edinburgh (UK)). Mar 1986. 32p. (SDD-P—1). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88750778/JAW.

The U.K. Government's current strategy for the long term in the management of radioactive wastes with reference to Scotland, taking account of the latest developments, is set out. Areas covered include responsible bodies, environmental monitoring, discharges from UK reprocessing sites, waste from reprocessing of spent fuel from overseas. (U.K.).

8585 (INIS-mf—11045, pp 57-84) **Geophysical investigations on the Vaalputs radioactive waste disposal site in the Republic of South Africa.** Andersen, N.J.B.; Faurie, J.N.; Fernandez, L.M. (Nuclear Development Corp. of South Africa, Pty. Ltd., Pelindaba, Pretoria). Dec 1986. NTIS (US Sales Only), PC A99/MF A01. Order Number DE88700435/JAW. (CONF-860909—).

From Conference on the treatment and containment of radioactive wastes and disposal in arid environments (Radwaste '86); Cape Town, South Africa (7 Sep 1986).

As the rocks of the Namaqualand Metamorphic Complex are sand-covered in the area of interest, extensive airborne and ground geophysical surveys were undertaken to assist with the evaluation of the regional and local geology, as well as to locate and avoid possible mineralization. A medium sensitivity aeromagnetic survey and an airborne INPUT survey were used to locate potentially mineralized kimberlite and noritoid intrusions. After airborne detection, these targets were followed up on the ground using electromagnetic and resistivity techniques. Subsequent drilling proved them to be unmineralized. A thermal infrared line-scan survey was used in conjunction with the aeromagnetics to evaluate the structural geology and assist with the location of groundwater. Continuous seismics refraction profiling was used to locate an area of rippable overburden (i.e. having a seismic velocity of less than 1 500 m/s) and depth greater than 10 m for the excavation of the low-level waste trenches. All boreholes were radiometrically logged. Since the Vaalputs area is entirely sand-covered it was essential to use geophysical techniques to evaluate the subsurface geology, and to avoid placing the facility in an area of economic mineralization.

8586 (INIS-mf—11045, pp 635-643) **Radioactive waste management at Rocky flats.** Navratil, J.D. (Rockwell International Corp., Golden, CO, USA. Rocky Flats Plant). Dec 1986. NTIS (US Sales Only), PC A99/MF A01. Order Number DE88700435/JAW. (CONF-860909—).

From Conference on the treatment and containment of radioactive wastes and disposal in arid environments (Radwaste '86); Cape Town, South Africa (7 Sep 1986).

Radioactive waste management at Rocky Flats involves the treating of process liquid wastes from the plutonium recovery areas and all other plant liquid process wastes which do not meet the requirements for on site impoundment. The treatment removes radioactive contaminants from aqueous process wastes and converts the resulting solids to a shippable form for storage off site. This paper gives a brief overview of the present production waste treatment process and provides details of a new ferrite waste treatment process presently undergoing production testing. Actinide removal and chemical properties of ferrites will be described as well as results to date of the testing of the ferrite waste treatment process.

8587 (IOS-Rep—228) **Moored current meter data from the Madeira Abyssal Plain (GME). 2nd deployment (1984).** Saunders, P.M. (Institute of Oceanographic Sciences, Godalming (UK)). 1986. 50p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88750770/JAW.

Near bottom currents have been measured at three closely spaced sites in the N.E. Atlantic for 22 months. This report describes the results for the period 13-22 months and closely follows the pattern used in describing the first 13 months of data (IOS Report No. 221, 1986). The three locations were in the Great Meteor East study site area, near 31° 30'N 25°W, one on the abyssal plain, one on top of a small abyssal hill about 400 m high and one on its eastern flank. For the period of this report current meters were moored 10,100 and 1000 m above the local bottom (5438 m, 5433 m and 4989 m) between February and November 1985. The characteristics of the currents are displayed in numerous tables and figures: the mean currents for the 9 months are strikingly similar to those measured for the first 13 months. The variations in current strengths are also similar and yield eddy energies of between 2 and 3 $cm^2\ s^{-2}$ and horizontal (isopycnal) diffusivity of $2x10^2\ m^2\ s^{-1}$. Currents in excess of 10 cm/s were considerably less frequent than found for the earlier data set.

8588 (JAERI-M—87-101) **Treatment test of spent solvents by submerged combustion process.** Uchiyama, Gunzo; Amakawa, Masayuki; Maeda, Mitsuru; Kuwayama, Koichi. (Japan Atomic Energy Research Inst., Tokyo). Jul 1987. 21p. (In Japanese). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88751065/JAW.

Tests with the pilot scale combustor (combustion capacity; 670,000 KJ/hr) were conducted to investigate the applicability of submerged combustion process to the treatment of spent solvents generated from fuel reprocessing facility. Simulated spent solvents of TBP and n-dodecane mixture (TBP vol%; 30 - 100) were tested. It was shown that they were completely combusted without any auxiliary fuel under the conditions of temperature; 1300 - 1500 deg C, air ratio; 1.2 - 1.4 regardless of the given TBP concentration. It was found that significant amount of mist was generated with the combustion and that inactive zirconium which was added as a simulant of non-volatile radionuclides to simulated spent solvents, was effectively collected and was concentrated in the quench tank.

8589 (LA-UR—87-139) **Environmental surveillance of low-level radioactive waste management areas at Los Alamos during 1985.** (Los Alamos National Lab., NM (USA)). 1987. Contract W-7405-ENG-36. 95p. NTIS, PC A05/MF A01; 1; GPO Dep. Order Number DE88002516/JAW.

This report was compiled as a part of the DOE-sponsored radioactive waste site surveillance program at Los Alamos National Laboratory. The report is a source document for data collected in

1985. However, an attempt is made to interpret the data as it relates to radionuclide transport to serve in guiding future waste site surveillance activities. This report contains information on one active and 11 inactive radioactive waste management areas at Los Alamos. Sections include the use history, current status, and future stabilization needs for all sites; the results of detailed surveillance activities at Areas G and C; and a dose evaluation based on the waste site and Laboratory environmental surveillance data. 9 refs., 30 figs., 13 tabs.

8590 **(ND-R—1316-R) Comparative estimates of risks arising from storage of intermediate level radioactive wastes.** Moore, D. (UKAEA Risley Nuclear Power Development Establishment). Apr 1986. 27p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88750767/JAW.

Estimates are presented of risks arising from accidents occuring during storage of nine types of conditioned intermediate level waste. Additional data are introduced relating to the risks from accidents affecting raw waste, and to risks associated with the occupational doses received during normal operation of a waste store. Risks in all three categories are shown to be extremely small.

8591 **(NRPB-M—97) Disposal of radioactive waste in evaporite formations - a review of published radiological assessments and their relevance to the UK.** Lawson, G. (National Radiological Protection Board, Chilton (UK)). Nov 1983. 36p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88750752/JAW.

Radiological assessments of the disposal of radioactive waste in evaporite formations, principally halite, have been reviewed. These assessments were carried out in the USA, the Netherlands, Denmark and West Germany. The general nature of evaporite formations in the UK is discussed and comments are given on the broad relevance of the assessments to the potential disposal of radioactive waste in UK evaporite formations.

8592 **(NUREG/CR—4735-Vol.2) Evaluation and compilation of DOE waste package test data: Biannual report, August 1986-January 1987.** Interrante, C.; Escalante, E.; Fraker, A.; Harrison, S.; Shull, R.; Linzer, M.; Ricker, R.; Ruspi, J. (National Bureau of Standards, Washington, DC (USA). Metallurgy Div.; Nuclear Regulatory Commission, Washington, DC (USA). Div. of High-Level Waste Management). Oct 1987. 136p. NTIS, PC A07/MF A01 - GPO. Order Number TI88900155/JAW.

This report summarizes results of the National Bureau of Standards (NBS) evaluations of Department of Energy (DOE) activities on waste packages designed for containment of radioactive high-level nuclear waste (HLW). The waste package is a proposed engineered barrier that is part of a permanent repository for HLW. Metal alloys are the principal barriers within the engineered system. Technical discussions are given for the corrosion of metals proposed for the canister, particularly carbon and stainless steels, and copper. In the section on tuff, the current level of understanding of several canister materials is questioned. Within the Basalt Waste Isolation Project (BWIP) section, discussions are given on problems concerning groundwater, materials for use in the metallic overpack, and diffusion through the packing. For the proposed salt site, questions are raised on the work on both ASTM A216 Steel and Ti-Code 12. NBS work related to the vitrification of HLW borosilicate glass at the West Valley Demonstration Project (WVDP) and the Defense Waste Processing Facility (DWPF) is covered. NBS reviews of selected DOE technical reports and a summary of current waste-package activities of the Materials Characterization Center (MCC) is presented. Using a database management system, a computerized database for storage and retrieval of reviews and evaluations of HLW data has been developed and is described. 17 refs., 2 figs., 2 tabs.

8593 **(NUREG/CR—4795) Long-term performance of high-level glass waste forms: [Technical report, June 1982-November 1986].** Means, J.L.; Spinosa, E.D.; Markworth, A.J.; McCoy, J.K.; Miller, N.E.; Kurth, R.E.; Taylor, G.C. (Battelle Columbus Div., OH (USA)). Nov 1987. 173p. (BMI—2143). NTIS, PC A08/MF A01 - GPO. Order Number TI88900195/JAW.

This report investigates the long-term performance of materials used for high-level waste packages. Glass waste-form studies, the topic of this report, focused on borosilicate glasses for both defense and commercial high-level wastes. Numerical modeling efforts describe the kinetics of glass dissolution, including the effects of water chemistry, and the kinetics of glass leaching assuming that silica precipitates as a more stable phase subsequent to dissolution from the glass. Glass leaching experiments conducted in this task included experimental validation of the numerical model for glass dissolution and precipitation, an evaluation of the effects of two natural organic acids on leaching of simulated waste glass, and an experimental study of the leaching behavior of devitrified MCC 76-68 glass specimens. Literature reviews also were conducted on the effects of both devitrification and radiation on glass-leaching behavior. Experiments documented the presence of experimental artifacts in glass leach tests under certain experimental conditions and examined the synergistic effects of temperature, pressure, surface-area-to-volume ratio, and leachate composition on glass leach rates. 100 refs., 41 figs., 22 tabs.

8594 **(NUREG/CR—4955) Long-term performance of container materials for high-level waste: [Technical report, April 1982-August 1987].** Beavers, J.A.; Thompson, N.G.; Markworth, A.J.; Cialone, H.J.; Majumdar, B.S.; McCoy, J.K. (Battelle Columbus Div., OH (USA)). Nov 1987. 427p. (BMI—2155). NTIS, PC A19/MF A01 - GPO. Order Number TI88900196/JAW.

This report describes the results of experimental and analytical studies of high-level waste container degradation. Corrosion and hydrogen embrittlement tests were conducted on selected materials to identify environmental and metallurgical factors that promote material degradation, especially stress-corrosion cracking. A major emphasis on overpack materials focused on cast and wrought low-carbon steels. Results of the corrosion work show that, to more completely identify potential failure modes, exposure environments must be further defined. Predictions of pitting rates based on models utilizing nonreactive walls may lead to rejection of carbon steel as a viable overpack material when, on the basis of performance, it may perform satisfactorily. Hydrogen embrittlement was shown to be promoted in regions of microstructural change such as the weld heat-affected zone. These findings show that hydrogen embrittlement is important to container integrity. A small portion of this task was devoted to studying the possible internal corrosion of the canister. It was found that Type 304L stainless steel will likely contain high-level waste glass for the retrieval period and probably the thermal period. Modeling studies focused on general corrosion and pitting corrosion, with the models being extended to account for more realistic conditions. Results show that pit wall reactivity is an important consideration in predicting corrosion rates. 102 refs., 132 figs., 57 tabs.

8595 **(NUREG/CR—4968) Evaluation of uncertainties in irradiated hardware characterization: Final report, September 30, 1986-March 31, 1987.** Bedore, N.; Levin, A.; Tuite, P. (Waste Management Group, Inc., Crompond, NY (USA)). Oct 1987. 100p. NTIS, PC A05/MF A01 - GPO. Order Number TI88900147/JAW.

Waste Management Group, Inc. has evaluated the techniques used by industry to characterize and classify irradiated hardware components for disposal. This report describes the current practices used to characterize the radionuclide content of hardware components, identifies the uncertainties associated with the techniques and practices considered, and recommends areas for improvement which could reduce uncertainty. Industry uses two different characterization methods. The first uses a combination of gamma scanning, direct sampling, underwater radiation profiling and radiochemical analysis to determine radionuclide content, while the second uses a form of activation analysis in conjunction with underwater radiation profiling. Both methods employ the determination of Cobalt 60 content, and the determination of scaling factors for hard-to-detect Part 61 radionuclides. The accurate determination of Cobalt-60 is critical since the Part 61 activation product radionuclides which affect Part 61 classification are scaled from Cobalt-60. Current uncertainties in Cobalt-60 determination can be reduced by improving underwater radiation profiling equipment and techniques. The calculational techniques used for activation analysis can

also be refined to reduce the uncertainties with Cobalt-60 determination. 33 refs., 11 figs., 10 tabs.

8596 **(NUREG/CR—4976) Plant rhizosphere processes influencing radionuclide mobility in soil.** Cataldo, D.A.; Cowan, C.E.; McFadden, K.M.; Garland, T.R.; Wildung, R.E. (Pacific Northwest Lab., Richland, WA (USA); Nuclear Regulatory Commission, Washington, DC (USA). Div. of Engineering). Oct 1987. Contract AC06-76RL01830. 80p. (PNL—6277). NTIS, PC A05/MF A01 - GPO. Order Number TI88002039/JAW.

Native vegetation associated with commercial low-level waste disposal sites has the potential for modifying the soil chemical environment over the long term and, consequently, the mobility of radionuclides. These effects were assessed for coniferous and hardwood tree species by using plants grown in lysimeter systems and examining their influence on soil solution chemistry using advanced analytical and geochemical modeling techniques. The study demonstrated formation of highly mobile anionic radionuclide complexes with amino acids, peptides, and organic acids originating from plant leaf litter and roots. The production of complexing agents was related to season and tree species, suggesting that vegetation management and exclusion may be appropriate after a site is closed. This research provides a basis for focusing on key complexing agents in future studies to measure critical affinity constants and to incorporate this information into mathematical models describing biological effects on radionuclide mobility. 26 refs., 5 figs., 23 tabs.

8597 **(NUREG/CR—4983) The sealing performance of bentonite/crushed basalt borehole plugs.** Williams, J.R.; Daemen, J.J.K. (Arizona Univ., Tucson (USA). Dept. of Mining and Geological Engineering). Nov 1987. 268p. NTIS, PC A12/MF A01 - GPO. Order Number TI88900188/JAW.

Mixtures of crushed rock and bentonite are considered for backfilling and sealing high-level nuclear waste repositories. Many variables affect the hydraulic conductivity of such mixtures, including the size and shape of the rock particles, method of mixing and emplacement, water content and density of the clay, and the weight ratio of rock to clay. Mixtures of crushed basalt and bentonite have been tested in two types of permeameters, 20 cm diameter stainless steel permeameters and 10 cm diameter PVC permeameters. Plugs were installed as a single lift or in many lifts; the water content of the clay ranged from air-dry to as high as 200%. Preliminary results show that a mixture of 75% crushed basalt and 25% bentonite has a hydraulic conductivity between 1×10^{-9} cm/s and 2.5×10^{-8} cm/s. In some cases, preferential flow paths have developed (possibly as a result of the montmorillonite washing out of the crushed rock matrix), giving hydraulic conductivities as high as 1×10^{-4} cm/s. Other ratios of rock to clay have similar bimodal results. The probability of failure is decreased by including a higher percentage of clay in the plug, crushing the rock finer, and evenly mixing the crushed rock and clay. 136 refs., 50 figs., 7 tabs.

8598 **(ORNL/Sub—86-78911/1) Regional inventory of karst activity in the Valley and Ridge Province, eastern Tennessee: Phase 1.** Newton, J.G.; Tanner, J.M. (LaMoreaux (P.E.) and Associates, Inc., Tuscaloosa, AL (USA)). Sep 1987. Contract AC05-84OR21400. 149p. NTIS, PC A07/MF A01; 1; GPO Dep. Order Number DE88001735/JAW.

A data collection form was developed for use in compiling information in the inventory. Information sources included files on subsidence, state and county highway departments, county agents and executives, soil conservation service representative, etc. Data obtained included location, date of occurrence, number of subsidence features at the reported site, size, topographic setting, geologic setting, and probable causative factors. The regional inventory obtained information on over 300 historic subsidence events at more than 200 sites in East Tennessee. Areas having the greatest areal density of active subsidence include Hamblen, Jefferson, and Loudon Counties. Reported subsidence events occurred between 1945 and 1986. The Knox Group dolomites account for about two-thirds of all reported sinkholes in the inventory. Most of the karst activity occurs in valleys or flat areas. In cases where causative factors could be established, the combination of surface water drainage alteration or impoundment combined with soil disturbance associated with construction activity were most often precursors to subsidence. 54 refs., 10 figs., 4 tabs.

8599 **(ORNL/Sub—86-78911/2) Assessment of subsidence in karst terranes at selected areas in East Tennessee and comparison with a candidate site at Oak Ridge, Tennessee: Phase 2.** Newton, J.G.; Tanner, J.M. (LaMoreaux (P.E.) and Associates, Inc., Tuscaloosa, AL (USA)). Sep 1987. Contract AC05-84OR21400. 103p. NTIS, PC A06/MF A01; 1; GPO Dep. Order Number DE88002170/JAW.

Work in the respective areas included assessment of conditions related to sinkhole development. Information collected and assessed involved geology, hydrogeology, land use, lineaments and linear trends, identification of karst features and zones, and inventory of historical sinkhole development and type. Karstification of the candidate, Rhea County, and Morristown study areas, in comparison to other karst areas in Tennessee, can be classified informally as youthful, submature, and mature, respectively. Historical sinkhole development in the more karstified areas is attributed to the greater degree of structural deformation by faulting and fracturing, subsequent solutioning of bedrock, thinness of residuum, and degree of development by man. Sinkhole triggering mechanisms identified are progressive solution of bedrock, water-level fluctuations, piping, and loading. 68 refs., 18 figs., 11 tabs.

8600 **(ORNL/TM—10479) Strategic influence on deep groundwater flow in the Knox Group Copper Ridge dolomite on the West Chestnut Ridge site.** Lee, R.R.; Ketelle, R.H. (Oak Ridge National Lab., TN (USA)). Oct 1987. Contract AC05-84OR21400. 36p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88003693/JAW.

The Copper Ridge Dolomite of the Upper Cambrian Knox Group underlies a site at Oak Ridge, Tennessee, under consideration by the Department of Energy (DOE) for a belowground waste disposal facility. The Copper Ridge was studied for DOE to understand the influence of lithology on deep groundwater flow. Three facies types are distinguished which comprise laterally continuous 1 to 4-m-thick rock units interpreted to represent upward-shallowing depositional cycles having an apparently significant effect on groundwater flow at depth. Rock core observations indicate one of the recurring facies types is characterized by thin to medium-bedded, fine-grained dolostone with planar cryptalgal laminae and thin shaley partings. Distinctive fracturing in this facies type, that may have resulted from regional structural deformation, is considered to be responsible for weathering at depth and the development of stratabound pathways of preferred groundwater flow. In addition, geophysical data suggest that one occurrence of this weathered facies type coincides with an apparent geochemical interface at depth. Geophysical data also indicate the presence of several fluid invasion horizons, traceable outside the study area, which coincide with the unweathered occurrence of this fine-grained facies type. The subcropping of recurrent zones of preferred groundwater flow at the weathered/unweathered interface may define linear traces of enhanced aquifer recharge paralleling geologic strike. Vertical projection of these zones from the weathered/unweathered rock interface to the ground surface may describe areas of enhanced infiltration. Tests to determine the role of stratigraphic controls on groundwater flow are key components of future investigations on West Chestnut Ridge.

8601 **(PNL—6241-Draft) National briefing summaries: Nuclear fuel cycle and waste management.** Schneider, K.J.; Harmon, K.M.; Lakey, L.T.; Silviera, D.J.; Leigh, I.W. (Pacific Northwest Lab., Richland, WA (USA)). Sep 1987. Contract AC06-76RL01830. 317p. NTIS, PC A14/MF A01; 1; GPO Dep. Order Number DE88002542/JAW.

This report is a compilation of publicly-available information concerning the nuclear fuel cycle and radioactive waste management strategies and programs of 20 nations and three international agencies that have publicized their activities in this field. The information in this document is compiled to provide summary information on radioactive waste management activities in other countries. This document indicates what is occurring in other countries with regard to strategies, activities, and facilities. This document first presents a short overview of the activities and trends for managing

low- to high-level radioactive waste and spent fuel by the entities covered in this review. This is followed by information for each country for nuclear power; fuel cycle and waste management strategy/policy; highlights and major milestones; institutional considerations/organizations; nuclear fuel production; fuel recycle; spent fuel storage and transport; waste conditioning, storage and transport; surface and near-surface waste disposal; geologic waste disposal; management of uranium mine and mill wastes; decommissioning; international; and references. 406 refs.

8602 **(PNL—6346) The Analytical Repository Source-Term (AREST) model: Description and documentation.** Liebetrau, A.M.; Apted, M.J.; Engel, D.W.; Altenhofen, M.K.; Strachan, D.M.; Reid, C.R.; Windisch, C.F.; Erikson, R.L.; Johnson, K.I. (Pacific Northwest Lab., Richland, WA (USA)). Oct 1987. Contract AC06-76RL01830. 207p. NTIS, PC A10/MF A01; 1; GPO Dep. Order Number DE88002488/JAW.

The geologic repository system consists of several components, one of which is the engineered barrier system. The engineered barrier system interfaces with natural barriers that constitute the setting of the repository. A model that simulates the releases from the engineered barrier system into the natural barriers of the geosphere, called a source-term model, is an important component of any model for assessing the overall performance of the geologic repository system. The Analytical Repository Source-Term (AREST) model being developed is one such model. This report describes the current state of development of the AREST model and the code in which the model is implemented. The AREST model consists of three component models and five process models that describe the post-emplacement environment of a waste package. All of these components are combined within a probabilistic framework. The component models are a waste package containment (WPC) model that simulates the corrosion and degradation processes which eventually result in waste package containment failure; a waste package release (WPR) model that calculates the rates of radionuclide release from the failed waste package; and an engineered system release (ESR) model that controls the flow of information among all AREST components and process models and combines release output from the WPR model with failure times from the WPC model to produce estimates of total release. 167 refs., 40 figs., 12 tabs.

8603 **(PNL-SA—14066) In situ vitrification: A new process for waste remediation.** Fitzpatrick, V.F.; Timmerman, C.L.; Buelt, J.L. (Pacific Northwest Lab., Richland, WA (USA)). Jul 1987. Contract AC06-76RL01830. 19p. (CONF-870941—1). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88001963/JAW.

From 2. international conference on new frontiers for hazardous waste management; Pittsburgh, PA, USA (27 Sep 1987).

In situ vitrification is a thermal treatment process that converts contaminated soil into a chemically inert, stable glass and crystalline product. A square array of four electrodes are inserted into the ground to the desired treatment depth. Because the soil is not electrically conductive once the moisture has been driven off, a conductive mixture of flaked graphite and glass frit is placed among the electrodes to act as the starter path. An electrical potential is applied to the electrodes, which establishes an electrical current in the starter path. The resultant power heats the starter path and surrounding soil up to 3600°F, well above the normal fusion temperature of soil of between 2000 and 2500°F. The graphite starter path is eventually consumed by oxidation, and the current is transferred to the molten soil, which is now electrically conductive. As the vitrified zone grows, it incorporates nonvolatile elements and destroys organic components by pyrolysis. The pyrolyzed byproducts migrate to the surface of the vitrified zone, where they combust in the presence of oxygen. A hood placed over the processing area provides confinement for the combustion gases, and the gases are drawn into the off-gas treatment system. 8 refs., 7 figs., 2 tabs.

8604 **(PNL/SRP-SA—14341) Proceedings of Salt Repository Project's workshop on brine migration.** (Pacific Northwest Lab., Richland, WA (USA)). Mar 1987. Contract AC06-76RL01830. 247p. (CONF-8504261—). NTIS, PC A11. Order Number DE87011908/JAW.

From Salt Repository Project workshop on brine migration; Berkeley, CA, USA (17 Apr 1985).

Individual papers are processed separately for the data bases. (TEM)

8605 (PNL/SRP-SA—14341, pp 7-8, Appendix C.53-C.58) **Amount and nature of occluded water in bedded salt, Palo Duro Basin, Texas.** Fisher, R.S. (Univ. of Texas, Austin). Mar 1987. NTIS, PC A11. Order Number DE87011908/JAW. (CONF-8504261—). Contract AC97-83WM46651.

From Salt Repository Project workshop on brine migration; Berkeley, CA, USA (17 Apr 1985).

The quantity and types of fluids within bedded salt cores from the Permian San Andres Formation, Palo Duro, Texas, were evaluated at the Texas Bureau of Economic Geology. Bedded halite from the San Andres Formation and other salt-bearing units were selected to represent the variety of salt types present, and were then analyzed. The mean water content of "pure" samples (more than 90% halite) is 0.4 weight percent, with none observed greater than 1.0 weight percent. Samples that contain more than 10 weight percent clay or mudstone display a trend of increasing water content with increasing clastic material. Chaotic mudstone-halite samples have as much as 5 weight percent water; halite-cemented mudstone interlayers, common throughout the bedded salts, may have water content values as high as 10 to 15 weight percent based on extrapolation of existing data that range from 0 to about 6%. No significant difference exists between the mean water content values of "pure salt" from the upper San Andres, lower San Andres Cycle 5, and lower San Andres Cycle 4 salt units. The fraction of total water present as mobile intergranular water is highly variable and not readily predicted from observed properties of the salt sample. The amount of water that would be affected by a high-level nuclear waste repository can be estimated if the volume of halite, the volume of clastic interlayers, and the amount and type of impurity in halite are known. Appendix contains seven vugraphs.

8606 (PNL/SRP-SA—14341, pp 8-9, Appendix C.59-C.64) **Fluid inclusion brine compositions from Palo Duro Basin salt sites.** Moody, J.B. Mar 1987. NTIS, PC A11. Order Number DE87011908/JAW. (CONF-8504261—). Contract AC02-83CH10140.

From Salt Repository Project workshop on brine migration; Berkeley, CA, USA (17 Apr 1985).

The fluid inclusion analyses were done on salt samples from Lower San Andres Cycle 4 and 5. The stable isotope composition of the fluid inclusion brines was measured on duplicate samples taken from the same fluid inclusion brine for correlation of geochemical content with the stable isotopic content. The analyzed Palo Duro Basin salt fluid inclusions are predominantly one phase, i.e., the presence of a fluid only. However, many of the larger fluid inclusions do have a small vapor bubble. This liquid/vapor ratio is so high in these vapor-containing fluid inclusions that their behavior in a thermal gradient would be almost identical to that of all liquid inclusions. Closely associated with the fluid inclusions are cryptomelane where some fibers penetrate into halite host crystal. The fluid inclusions have a wide variability in content for those components that were analyzed, even within the same salt type. The fluid inclusion brines are also acidic, ranging from 3 to 6 as measured with pH test papers.

8607 (PNL/SRP-SA—14341, pp 9-11, Appendix C.65-C.68) **Preliminary report on WIPP brine compositions.** Krumhansl, J.L.; Stein, C.L. (Sandia National Labs., Albuquerque, NM). Mar 1987. NTIS, PC A11. Order Number DE87011908/JAW. (CONF-8504261—). Contract AC04-76DP00789.

From Salt Repository Project workshop on brine migration; Berkeley, CA, USA (17 Apr 1985).

We present analyses of macro- and microscopic brines observed within the WIPP facility and in the surrounding halite, with interpretations regarding the origin and history of these fluids and their potential effect(s) on long-term waste storage. During excavation, two distinct populations of inclusions were recovered from an area of highly-recrystallized halite in a thick salt bed at the repository horizon (2150 ft below ground level). We propose that the dis-

tinct inclusion compositions arise from the alteration of calcium sulfate to polyhalite and calcium carbonate to magnesite. Brine "seeps" were collected from walls of recently excavated drifts at the same stratigraphic horizon as the fluid inclusion samples. Analyses of these fluids show that they differ substantially in composition from the inclusion fluids, due to magnesium depletion and potassium enrichment. Since seeps are associated with argillaceous or anhydritic halite, these fluids may have originated by dewatering of clays and/or gypsum. Finally, holes in the facility floor that filled with brine were sampled. The analyses resemble the weep compositions but with greater variation in both K/Mg and Na/Cl. Although a wide variety of brines are found at the WIPP site, they could all be classified as calcium-poor, polycomponent brines that differ significantly from evaporated seawater. That these fluids exist in close proximity to each other suggests the absence of an interconnected hydrologic system which could effectively transport radionuclides away from the repository; that brine migration studies must consider the mobility of intergranular fluids as well as those in inclusions; and that materials' testing programs need to evaluate a wide range of brines. Appendix contains three vugraphs.

8608 (PNL/SRP-SA—14341, pp 11-12, Appendix C.101-C.106) **ASU testing of water in salt.** Knauth, P.L. (Arizona State Univ., Tempe, AZ). Mar 1987. NTIS, PC A11. Order Number DE87011908/JAW. (CONF-8504261—).

From Salt Repository Project workshop on brine migration; Berkeley, CA, USA (17 Apr 1985).

Stable isotope measurements have been used to determine the origin of water leaking into salt mines in the Gulf Coast salt domes. Water "pockets" are found around the periphery of the domes and in association with sediment inclusions. Isotopic data indicate that these waters are formation waters that have been mechanically wrapped into the domes during diapiric rise of the salt. Meteoric waters are actively leaking into the Avery Island salt mine. These leaks represent penetration of the salt by external waters. The mechanism of brine movement is unknown. A third water type in domal salt appears to be connate brines evaporated to potash facies. These brines are so concentrated that they turn to a gel at liquid nitrogen temperatures; they will not freeze. Isotopic analyses of fluid inclusions in the bedded salts of the Palo Duro Basin indicate that the trapped water is mainly connate evaporate water dating back to the time of salt deposition. In the Avery Island salt dome, observations include ghost grain boundaries defined by curviplanar arrays of fluid inclusions within coarse halite crystals. These are either former grain boundaries or fracture surfaces. Parallel planes of intracrystalline fluid inclusions clearly indicate natural fracturing of salt with consequent movement of brine. Water appears to have migrated upwards of 50 meters from localized water "pockets" via these mechanisms.

8609 (PNL/SRP-SA—14341, pp 13-14, Appendix C.23-C.36) **Overview of waste package and repository conceptual designs and the corresponding near-field conditions.** Cunnane, J.C. Mar 1987. NTIS, PC A11. Order Number DE87011908/JAW. (CONF-8504261—). Contract AC02-83CH10140.

From Salt Repository Project workshop on brine migration; Berkeley, CA, USA (17 Apr 1985).

Conceptual designs for spent fuel (SF), defense (DHLW), and commercial (CHLW) high level waste packages, repository layout concepts, waste package emplacement configurations, and anticipated key environmental factors were presented. Design features for the waste package and repository are closely related to environmental conditions in the near field. These features include waste package heat output, overpack wall thickness, area heat loading, dimensions of the waste package/borehole annulus at emplacement, and package emplacement pitch. Container material planned for all three waste forms is low carbon steel. Reference thickness of the container ranges from 8.63 cm for DHLW to 10.0 cm for SF. Borosilicate glass will be the waste form for DHLW. The DHLW will be combined with glass formers, melted and poured into a stainless steel canister approximately 61 cm in diameter and 3 m long. The canister will be filled to 85% capacity and placed in the low carbon steel container. Spent fuel assemblies will be consolidated and inserted into the low carbon steel container, and the closure welded. Key environmental factors were defined as those influencing brine migration to or away from the waste package; container corrosion; or radionuclide release after container breach. Factors include temperature, gamma radiation field intensity, pressure, brine inflow rate, and brine chemistry. Appendix contains 23 vugraphs.

8610 (PNL/SRP-SA—14341, pp 14, Appendix C.65-C.68) **Overview of WIPP waste package and repository conceptual designs.** Krumhansl, J.L. (Sandia National Labs., Albuquerque, NM). Mar 1987. NTIS, PC A11. Order Number DE87011908/JAW. (CONF-8504261—). Contract AC04-76DP00789.

From Salt Repository Project workshop on brine migration; Berkeley, CA, USA (17 Apr 1985).

This presentation described the stratigraphy of the WIPP site, repository design, test room configurations, and a variety of tests that are either planned or ongoing. Shown and described were the location of site and preliminary design validation tests, technology experiments, actual DHLW tests and full-scale TRU waste isolation demonstration area. In-situ tests with DHLW will last from several years to several decades. WIPP Brine A, an inclusion brine typical of that found at the WIPP site, will be injected into the test boreholes. A crushed salt/bentonite backfill will be used.

8611 (PNL/SRP-SA—14341, pp 15, Appendix C.37-C.46) **Post emplacement conditions in the very-near field.** Ratigan, J.L. (RE/SPEC Inc., Rapid City, SD). Mar 1987. NTIS, PC A11. Order Number DE87011908/JAW. (CONF-8504261—). Contract AC02-83CH10140.

From Salt Repository Project workshop on brine migration; Berkeley, CA, USA (17 Apr 1985).

Emplacement of a radioactive waste package in a borehole in the floor of an underground drift in salt will increase temperature and mean stress (pressure) in the near vicinity of the waste package. The eventual temperature rise in the waste package region will depend on package spacing among other things. However, the salt nearest the waste package can be expected to experience temperatures of about 200 to 250°C for a limited period of time. Associated with the transient thermal response in the vicinity of the waste package is a corresponding increase in the mean stress around the waste package. The magnitude of this mean stress increase depends to some degree on the size of the annulus between the waste package and the salt borehole wall, as well as the infilling material (if any) in the annulus. The larger the annulus, the lower the maximum mean stress increase. Also, the larger the annulus, the later in time the maximum mean stress will occur. Crushed salt can be expected to consolidate and recrystallize very early in the repository history. Thus, within a few years, the mean stress in the salt in the vicinity of the waste package will be essentially equal to the preemplacement lithostatic mean stress. Appendix contains 19 vugraphs.

8612 (PNL/SRP-SA—14341, pp 16-18, Appendix C.107-C.115) **Near-field environment research at PNL relevant to brine migration phenomena.** Pederson, L.R.; Gray, W.J.; Hodges, F.N. Mar 1987. NTIS, PC A11. Order Number DE87011908/JAW. (CONF-8504261—). Contract AC06-76RL01830.

From Salt Repository Project workshop on brine migration; Berkeley, CA, USA (17 Apr 1985).

Heat and radiation resulting from emplacement of a high level nuclear waste package in a repository in salt will cause physical and chemical changes in the host rock and any brines present. These changes may alter the performance of waste package materials. Gamma radiolysis decomposes water into hydrogen and oxygen, hydrogen peroxide, and various other free radical and ionic species. Gamma ray irradiation of rock salt decomposes that salt to sodium metal colloids and neutral chlorine (unknown form), changing both its physical and chemical properties. Sodium metal will react, if contacted by water, to form sodium hydroxide plus hydrogen gas, while chlorine will react to form hydrochloric plus hypochlorous acids. If irradiated salts are completely dissolved, little impact on the chemical environment is expected because the acids and bases formed will neutralize each other. Heat from the waste package can alter the chemistry of the host rock. Changes in temperature can also alter the chemistry of brines by precipitation of phases with retrograde solubility, addition of more soluble salt components to the brine, and by reaction with clays and other im-

purities in the salt. Some of these reactions could be accompanied by significant shifts in the pH. In experiments to date, no important changes in chemistry have been observed when typical Permian Basin intrusion or inclusion brines were heated up to 150°C with no excess site-specific salt present. When excess salt was included, acidic shifts were noted, increasing with brine-salt interaction time and temperature.

8613 (PNL/SRP-SA—14341, pp 18, Appendix C.117-C.132) **Asse brine migration and in-situ testing status report.** Coyle, A.J. Mar 1987. NTIS, PC A11. Order Number DE87011908/JAW. (CONF-8504261—).

From Salt Repository Project workshop on brine migration; Berkeley, CA, USA (17 Apr 1985).

This presentation contains a status report of field tests conducted in salt mines. Included are ongoing tests at the Asse Salt Mine in the Federal Republic of Germany (FRG) and tests conducted at Avery Island in the US. The Asse tests simulate an actual repository with heat and gamma radiation output exceeding that of US and FRG conceptual waste packages. Brine migration rates, room closure rates, and other thermal mechanical behavior of salt were reported. The Avery Island Salt Mine tests included several heater tests, brine migration experiments, permeability tests and accelerated corejack tests to obtain creep data under various temperature and pressure gradients. Also discussed was the In-Situ Test Plan, which is undergoing review and will be implemented using the exploratory shaft site as well as other off-site mine testing.

8614 (PNL/SRP-SA—14341, pp 19-21, Appendix C.5-C.10) **SRP materials testing information and data needs.** Clark, D.E. Mar 1987. NTIS, PC A11. Order Number DE87011908/JAW. (CONF-8504261—). Contract AC02-83CH10140.

From Salt Repository Project workshop on brine migration; Berkeley, CA, USA (17 Apr 1985).

The Savannah River Plant (SRP) will license and construct an underground repository in salt for HLW and DHLW. Waste package performance requirements are an essentially complete containment of radioactivity in the waste package for a period of 300 to 1000 years, and a controlled or limited release of radioactivity from the waste package and the engineered barrier system. Performance requirements are trivial unless the waste package is contacted by fluids. An advantage of a salt repository is its dryness, with limited fluids available for interactions with emplaced waste packages. The fluids that are present in salt (saturated brine solutions) are aggressive toward some of the waste package components. The fluids that might contact the emplaced waste package are water inflow due to failure of the sealing system, human intrusion, etc. Such fluids are referred to as "intrusion brines" and are generally expected to be NaCl-type brines. Water present in the salt include chemically bound water found in various minerals and clays, "free" or sorbed water (e.g., in clays), and brine inclusions. Solubilities of brine constituents generally increase with temperature.

8615 (PNL/SRP-SA—14341, pp 21-24, Appendix C.17-C.22) **Data and information needs for WPP testing and component modeling.** Kuhn, W.L. Mar 1987. NTIS, PC A11. Order Number DE87011908/JAW. (CONF-8504261—). Contract AC06-76RL01830.

From Salt Repository Project workshop on brine migration; Berkeley, CA, USA (17 Apr 1985).

The modeling task of the Waste Package Program (WPP) is to develop conceptual models that describe the interactions of waste package components with their environment and the interactions among waste package components. The task includes development and maintenance of a database of experimental data, and statistical analyses to fit model coefficients, test the significance of the fits, and propose experimental designs. The modeling task collaborates with experimentalists to apply physicochemical principles to develop the conceptual models, with emphasis on the subsequent mathematical development. The reason for including the modeling task in the predominantly experimental WPP is to keep the modeling of component behavior closely associated with the experimentation. Whenever possible, waste package degradation processes are described in terms of chemical reactions or transport processes. The integration of equations for assumed or calculated repository conditions predicts variations with time in the repository. Within the context of the waste package program, the composition and rate of arrival of brine to the waste package are environmental variables. These define the environment to be simulated or explored during waste package component and interactions testing. The containment period is characterized by rapid changes in temperature, pressure, oxygen fugacity, and salt porosity. Brine migration is expected to be most rapid during this period. The release period is characterized by modest and slowly changing temperatures, high pressure, low oxygen fugacity, and low porosity. The need is to define the scenario within which waste package degradation calculations are to be made and to quantify the rate of arrival and composition of the brine. Appendix contains 4 vugraphs.

8616 (PNL/SRP-SA—14341, pp 24-25, Appendix C.75-C.82) **Thermal gradient migration of brine inclusions in salt.** Olander, D.; Machiels, A.; Yagnik, S. (Univ. of California, Berkeley). Mar 1987. NTIS, PC A11. Order Number DE87011908/JAW. (CONF-8504261—).

From Salt Repository Project workshop on brine migration; Berkeley, CA, USA (17 Apr 1985).

An apparatus was used to measure velocities of inclusions in synthetic single crystals (NaCl and Kcl) and in natural rock salt under various conditions of temperature gradient and uniaxial stress. The migration velocities of the inclusions were found to be dependent on temperature, temperature gradient, and inclusion shape and size. The velocities were also dictated by the interfacial mass transfer resistance at the brine/solid interface. This interfacial resistance depends on the dislocation density in the crystal, which, in turn, depends on the axial compressive loading of the crystal. At low axial loads, the dependence between the velocity and temperature gradient is non-linear. At high axial loads the interfacial resistance is reduced and the migration velocity depends linearly on the temperature gradient. Intragranular inclusions move under the influence of the temperature gradient only as far as the boundary of the grain in which they are contained. At the grain boundary, the migrating inclusions are trapped and deliver their brine and their volume to the interconnected porosity. VAPMIG, which combines brine inclusion migration and vapor transport and bulk diffusion in interconnected porosity, has been developed to predict the release of water and brine to a drillhole in rock salt heated by nuclear wastes.

8617 (PNL/SRP-SA—14341, pp 25) **Threshold temperature gradient effect on migration of brine inclusions in salt.** Pigford, T.H. (Univ. of California, Berkeley). Mar 1987. NTIS, PC A11. Order Number DE87011908/JAW. (CONF-8504261—).

From Salt Repository Project workshop on brine migration; Berkeley, CA, USA (17 Apr 1985).

Theories of the migration of brine inclusions in salt were interpreted as simple physical processes, and theories by Russian and US workers were shown to yield the same results. The migration theory was used to predict threshold temperature gradients below which migration of brine inclusions should not occur. The predicted threshold gradients were compared with the temperature gradients expected at the Waste Isolation Pilot Plant in New Mexico. The theory of threshold gradients helps explain the existence of brine inclusions in natural salt deposits.

8618 (PNL/SRP-SA—14341, pp 25-28, Appendix C.41-C.46) **Brine migration modeling at RE/SPEC.** Ratigan, J.L. (RE/SPEC, Rapid City, SD). Mar 1987. NTIS, PC A11. Order Number DE87011908/JAW. (CONF-8504261—).

From Salt Repository Project workshop on brine migration; Berkeley, CA, USA (17 Apr 1985).

Emplacement of a radioactive waste package in a borehole in the floor of an underground drift in salt will result in an increase in temperature and mean stress (pressure) in the very-near field of the waste package. RE/SPEC Inc. has been involved in five brine migration modeling efforts including the finite element computer code, SPECTROM-58, for the analysis of brine transport in rock salt; stochastic modeling of brine inflow into a borehole containing a commercial high-level waste package; stochastic modeling of the Salt Block II experiment at Sandia National Laboratories; docu-

mentation of the SPECTROM-58 code to the Nuclear Regulatory Commission standard, NUREG-0856; and evaluation of the brine migration results in the environmental assessment reports for the salt sites being considered by the Department of Energy.

8619 (PNL/SRP-SA—14341, pp 29-30, Appendix C.83-C.90) **Salt as a porous thermoelastic material: laboratory and field applications.** McTigue, D.F. (Sandia National Labs., Albuquerque, NM). Mar 1987. NTIS, PC A11. Order Number DE87011908/JAW. (CONF-8504261—). Contract AC04-76DP00789.

From Salt Repository Project workshop on brine migration; Berkeley, CA, USA (17 Apr 1985).

A model was developed that represents salt as a fluid-saturated, porous, thermoelastic medium. The theory allows for compressibility and thermal expansion of both the pore water and the salt. The elements of the theory include mass and momentum balances for the fluid, momentum and energy balances for the fluid-solid mixture, and a compatibility equation. The model has been applied to one stage of the Salt Block II experiment. In this experiment, the fluid flux into a heated borehole in a large cylinder of salt was measured over time. The success of the model suggests that, at least under the special conditions of the first stage of the Salt Block II experiment, the water collected was intergranular (pore) water that moved by Darcian flow. Appendix contains seven vugraphs.

8620 (PNL/SRP-SA—14341, pp 30-31, Appendix C.91-C.99) **ONWI models for simulating brine migration in salt.** Bloom, S.G. (Office of Nuclear Waste Isolation, Columbus, OH). Mar 1987. NTIS, PC A11. Order Number DE87011908/JAW. (CONF-8504261—). Contract AC02-83CH10140.

From Salt Repository Project workshop on brine migration; Berkeley, CA, USA (17 Apr 1985).

Models based on flow due to a temperature gradient and flow due to a concentration gradient were presented. In the Environmental Assessment (EA) reports, the temperature model was used to estimate flow rates and cumulative volume to the waste package to estimate package failure and radionuclide release rates. The concentration model was used to estimate radionuclide transport away from the package in the absence of ground-water intrusion. For the EA reports, the temperature model was solved using a finite-difference computer program named BRINEMIG but a semianalytical approximation was later developed. This approximation was presented along with a graph comparing the finite-difference and semianalytical results with data from the Salt Block II experiment. The concentration model and appropriate solutions were presented for three different sets of boundary conditions. Appropriate solutions were fit to 2 sets of brine concentration data that were assumed to be due to brine movement over periods of millions of years and one set of data on brine flow rates over a period of 200 days. Effective diffusion coefficients could be derived from these fits. Although no plausible physical explanation was offered for a diffusion mechanism, the consistency of the derived coefficients indicated that the mechanism could be used to simulate brine movement in the absence of a temperature gradient.

8621 **(RFP—4095) Organic and sludge immobilization system.** Petersen, R.D.; Thomas, R.L. (ed.). (Rockwell International Corp., Golden, CO (USA). Rocky Flats Plant). 27 Jul 1987. Contract AC04-76DP03533. 16p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88002486/JAW.

An Organic and Sludge Immobilization System (OASIS) has been implemented at the Rocky Flats Plant to solidify transuranic waste organic liquids and sludges from the aqueous waste processing facility to meet the Waste Isolation Pilot Plant, Waste Acceptance Criteria. 3 refs., 8 figs., 4 tabs.

8622 **(RFP—4148) Application of microwave energy for in-drum solidification of simulated precipitation sludge.** Petersen, R.D.; Johnson, A.J.; Swanson, S.D.; Thomas, R.L. (ed.). (Rockwell International Corp., Golden, CO (USA). Rocky Flats Plant). 17 Aug 1987. Contract AC04-76DP03533. 35p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88002482/JAW.

The application of microwave energy for in-container solidification of simulated transuranic contaminated precipitation sludges has been tested. Results indicate volume reductions to 83% are achievable by the continuous feeding of pre-dried sludge into a waste container while applying microwave energy. An economic evaluation was completed showing achievable volume and weight reductions to 87% compared with a current immobilization process for wet sludge. 7 refs., 15 figs., 16 tabs.

8623 **(SAND—84-2641-Vol.1) Site characterization plan: Conceptual design report, Volume 1: Chapters 1-3.** MacDougall, H.R.; Scully, L.W.; Tillerson, J.R. (comps.). (Sandia National Labs., Albuquerque, NM (USA); Bechtel National, Inc., San Francisco, CA (USA); Parsons, Brinckerhoff, Quade and Douglas, Inc., San Francisco, CA (USA)). Sep 1987. Contract AC04-76DP00789. 277p. NTIS, PC A13/MF A01; 1; GPO Dep. Order Number DE88003720/JAW.

The site for the prospective repository is located at Yucca Mountain in southwestern Nevada, and the waste emplacement area will be constructed in the underlying volcanic tuffs. The target horizon for waste emplacement is a sloping bed of densely welded tuff more than 650 ft below the surface and typically more than 600 ft above the water table. The conceptual design described in this report is unique among repository designs in that it uses ramps in addition to shafts to gain access to the underground facility, the emplacement horizon is located above the water table, and it is possible that 300- to 400-ft-long horizontal waste emplacement boreholes will be used. This report summarizes the design bases (site and properties of the waste package), design and performance criteria, and the design analyses performed. The current status of meeting the preclosure performance objectives for licensing and of resolving the repository design and preclosure issues is presented. The repository design presented in this report will be expanded and refined during the advanced conceptual design, the license application design, and the final procurement and construction design phases.

8624 **(SAND—87-0293C) Drying of an initially saturated fractured volcanic tuff.** Russo, A.J.; Reda, D.C. (Sandia National Labs., Albuquerque, NM (USA)). 14 Apr 1987. Contract AC04-76DP00789. 25p. (CONF-871234—1). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88002325/JAW.

From ASME winter meeting; Boston, MA, USA (13 Dec 1987).

The isothermal drying of an initially saturated welded tuffaceous rock was studied experimentally. Gamma-beam densitometry was used to measure the material's effective porosity distribution prior to the drying experiment. It was then used to measure liquid saturation distributions during a 1400 hour drying period. The core selected for study was taken from the Busted Butte outcrop at the Nevada Test Site, part of the Topopah Spring Member of Paintbrush tuff. This specimen contained several microfractures transversely oriented to the direction of the water or vapor migration. These fractures were found to be regions of rapid dryout or low saturation even though they were displaced from the surface over which dry nitrogen was flowing. An imbibition experiment was performed earlier on the same core. In the imbibition experiment the presence of most of these microfractures was detected by discontinuities in the measured saturation curves, which indicated a delay in liquid transport past the microfractures. The mechanism for this inside out drying is believed to be capillary action that removes water from the larger-pore fracture zone. Vapor pressure lowering in the fine pore region, which would result in transport by evaporation, diffusion and condensation, is thought not to be important at room temperatures. Modeling of this dryout experiment reproduced some of the overall features of the experiment but underpredicted the saturation near the drying surfaces. 8 refs., 11 figs.

8625 **(SAND—87-1990) Hydrostatic creep consolidation of crushed salt with added water.** Holcomb, D.J.; Shields, M. (Sandia National Labs., Albuquerque, NM (USA)). Oct 1987. Contract AC04-76DP00789. 125p. NTIS, PC A06/MF A01; 1; GPO Dep. Order Number DE88002819/JAW.

Adding small amounts of water to the as-mined salt results in a consolidation rate such that times required for the salt to form an

effective barrier to fluid flow are of the order of 1 year, at stresses in the 1 MPa range. Two different extrapolations were used, one biased towards a high estimate and the other towards a low estimate. Down to the lowest level of added water, .5% by mass, no threshold was observed for the effect. Rates are significantly higher than for the as-mined dry salt, although there are very few long-term dry tests to compare with. A sample was consolidated to a state where the permeability was comparable to the formation permeability, under conditions representative of the WIPP. Consolidation is sufficiently rapid that the rate determining process is the drift closure which will be required to close enough to take up the roughly 30% void space in the reemplaced backfill. The mechanism of consolidation and why it is so sensitive to water are not known, although it is clear that some form of pressure solution is a possibility. 14 refs., 82 figs., 2 tabs.

8626 **(SAND—87-7124) Analysis of pumping tests of the Culebra dolomite conducted at the H-11 hydropad at the Waste Isolation Pilot Plant (WIPP) site.** Saulnier, G.J. Jr. (Intera Technologies, Inc., Austin, TX (USA); Sandia National Labs., Albuquerque, NM (USA)). 25 Sep 1987. Contract AC04-76DP00789. 199p. NTIS, PC A09/MF A01; 1; GPO Dep. Order Number DE88002246/JAW.

The Culebra Dolomite Member of the Permian Rustler Formation was hydrologically evaluated in a series of pumping tests conducted at the H-11 hydropad at the Waste Isolation Pilot Plant (WIPP) site. At H-11, the Culebra dolomite is a 25-ft thick argillaceous dolomite with 0.1- to 0.5-foot thick layers with a high density of vugs. The vugs range in size from 0.1 to 0.5 inches in diameter; most are 0.1 to 0.2 inches in diameter. The thin vuggy layers alternate with thicker, more competent layers which have few vugs, but which do contain high-angle fractures. Some of the vugs and fractures are gypsum-filled. Three pumping tests consisted of 12- to 21-hour pumping periods at each of the three wells, while using the other two wells at the hydropad as observation wells. An additional pumping test was conducted at H-11b3 with H-11b1 and H-11b2 as observation wells. The test was a 32-day multirate test with four pumping and recovery periods. The original tests were conducted by lowering a submersible pump and pressure transducers in the boreholes. The additional test added a downhole packer with feedthrough assembly designed to isolate the test interval and reduce or minimize the effect of wellbore storage. The data from all tests were recorded and stored on floppy disks. The pumping tests at the H-11 hydropad were analyzed with the INTERPRET reservoir-analysis software. 46 refs., 46 figs., 12 tabs.

8627 **(SKB-TR—86-20) Preliminary structural analysis of the pattern of post-glacial faults in Northern Sweden.** Talbot, C. (Swedish Nuclear Fuel and Waste Management Co., Stockholm; Uppsala Univ. (Sweden)). Oct 1986. 39p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88751257/JAW.

The post-glacial kinematics inferred from the structures suggest horizontal NW or WNW compression with lateral relief to the NE at depth below surficial upward relief. These kinematics are sufficiently similar to the kinematics throughout Europe north of the Alps to suspect the neotectonic motion of the Eurasian lithospheric plate over the last 38 or even 58 (+/- 2)Ma as the causative force. Large displacements appear to have occurred within a hundred years or so of the last ice retreating from any particular part of northern Scandinavia. This suggests a sudden relief during glacial unloading (and melting of ground water) of plate tectonic forces accumulated during glacial loading. Recent earthquakes in the region display similar kinematics to the post-glacial fractures on a regional scale but indications of ground movement along the forested fault scarps in the lifetime of the trees is observed at only a few localities. Only geodetic strain measurements or small-earthquake monitoring will resolve whether current ductile or seismic motion is occuring along the most obvious post-glacial scarps. Such investigations are under way.

8628 **(SKB-TR—86-22) Description of hydrogeological data in SKB's database GEOTAB.** Gentzschein, B. (Swedish Nuclear Fuel and Waste Management Co., Stockholm). Dec 1986. 119p. NTIS (US Sales Only), PC A06/MF A01. Order Number DE88751258/JAW.

Since 1977 Swedish Nuclear Fuel and Waste Management Co., SKB has been performing a research and development programme for final disposal and spent nuclear fuel. The purpose of the programme is to acquire knowledge and data of radioactive waste. Measurement for the characterisation of geological, geophysical, hydrogeological and hydrochemical conditions are performed in specific site investigations as well as for geoscientific projects. A database, called GEOTAB, was investigated. It is based on a concept from Mimer Information System, and have been further developed by Ergo-Data. The hardware is a VAX 750 computer located at KRAB (Kraftverksbolagens Redovisningsavdelning AB) in Stockholm.

8629 **(UCID—21190) Plan for glass waste form testing for NNWSI [Nevada Nuclear Waste Storage Investigations].** Aines, R.D. (Lawrence Livermore National Lab., CA (USA)). Sep 1987. Contract W-7405-ENG-48. 33p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88003266/JAW.

The purpose of glass waste form testing is to determine the rate of release of radionuclides from breached glass waste containers. This information will be used to qualify glass waste forms with respect to the release requirements. It will be the basis of the source term from glass waste for repository performance assessment modeling. This information will also serve as part of the source term in the calculation of cumulative releases after 100,000 years in the site evaluation process. It will also serve as part of the source term input for calculation of cumulative releases to the accessible environment for 10,000 years after disposal, to determine compliance with EPA regulations. This investigation will provide data to resolve information needs. Information about the waste forms which is provided by the producer will be accumulated and evaluated; the waste form will be tested, properties determined, and mechanisms of degradation determined; and models providing long-term evaluation of release rates designed and tested. 23 refs.

8630 **(USGS-OFR—87-199) A reconnaissance assessment of probabilistic earthquake accelerations at the Nevada Test Site.** Perkins, D.M.; Thenhaus, P.C.; Hanson, S.L.; Algermissen, S.T. (Geological Survey, Denver, CO (USA)). 1986. Contract AI08-78ET44802. 29p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88002166/JAW.

We have made two interim assessments of the probabilistic ground-motion hazard for the potential nuclear-waste disposal facility at the Nevada Test Site (NTS). The first assessment used historical seismicity and generalized source zones and source faults in the immediate vicinity of the facility. This model produced relatively high probabilistic ground motions, comparable to the higher of two earlier estimates, which was obtained by averaging seismicity in a 400-km-radius circle around the site. The high ground-motion values appear to be caused in part by nuclear-explosion aftershocks remaining in the catalog even after the explosions themselves have been removed. The second assessment used particularized source zones and source faults in a region substantially larger than NTS to provide a broad context of probabilistic ground motion estimates at other locations of the study region. Source faults are mapped or inferred faults having lengths of 5 km or more. Source zones are defined by boundaries separating fault groups on the basis of direction and density. For this assessment, earthquake recurrence has been estimated primarily from historic seismicity prior to nuclear testing. Long-term recurrence for large-magnitude events is constrained by geological estimates of recurrence in a regime in which the large-magnitude earthquakes would occur with predominately normal mechanisms. 4 refs., 10 figs.

8631 **Models for calculating dissolution rates of high-level waste.** Ross, B. *Nuclear Safety;* **28**: No. 3, 362-373(Jul-Sep 1987).

The rates at which nuclides contained in high-level wastes are released into solution may be controlled by chemical kinetics, equilibrium solubilities, or solid-state diffusion. Recent research has focused on equilibrium solubility as a relatively predictable factor that in many situations can be expected to hold release rates to low levels. Simple analytic solutions based on equilibrium solubility are available to describe dissolution in various physical situations. For

more soluble elements, chemical kinetics may need to be invoked if low release rates must be demonstrated. 47 refs., 2 figs.

8632 **WIPP waste handling processes and equipment.** Chiquelin, W.R.; Halverson, T.W. (Westinghouse Electric Corp., Carlsbad, NM 88220). pp 627-630 of Waste management '87: Waste isolation in the US, technical programs, and public education. Post, R.G. Tucson, AZ; University of Arizona Nuclear Engineering Dept. (1987). (CONF-870306—).

From Waste management '87; Tucson, AZ, USA (1 Mar 1987).

The Start Clean, Stay Clean operating philosophy of the Waste Isolation Pilot Plant (WIPP) has resulted in a total quality waste handling environment. The WIPP can handle both contact-handled (CH) and remote-handled (RH) waste independently of one another, beginning with truck or rail shipment. This article describes the waste emplacement and retrieval procedures that will be validated prior to the October 1988 receipt of waste, emphasizing the WIPP's implementation of the latest technology and the project's application of many waste handling improvement techniques.

8633 **Prediction of waste glass melt rates.** Lee, L.M. (E.I. du Pont de Nemours and Co., Savannah River Lab., Aiken, SC 29808). pp 591-594 of Waste management '87: Waste isolation in the US, technical programs, and public education. Post, R.G. Tucson, AZ; University of Arizona Nuclear Engineering Dept. (1987). (CONF-870306—).

From Waste management '87; Tucson, AZ, USA (1 Mar 1987).

Under contract to the Department of Energy, the Du Pont Company has begun construction of a Defense Waste Processing Facility to immobilize radioactive wastes now stored as liquids at the Department of Energy's Savannah River Plant. The immobilization process solidified waste sludge by vitrification into a leach-resistant borosilicate glass. Development of this process has been the responsibility of the Savannah River Laboratory. As part of thee development, a simple model was developed to predict the melt rates for the waste glass melter. This model is based on an energy balance for the cold cap and gives very good agreement with melt rate data obtained from experimental campaigns in smaller scale waste glass melters.

8634 **Test concept for waste package environment tests at Yucca Mountain.** Yow, J.L. Jr. (Lawrence Livermore National Lab., CA). pp 1035-1042 of Rock mechanics: Proceedings of the 28th U.S. symposium. Farmer, I.W.; Daemen, J.J.K.; Desai, C.S.; Glass, C.E.; Neuman, S.P. Accord, MA; A.A. Balkema Publishers (1987). (CONF-870625—). Contract W-7405-ENG-48.

From 28. U.S. symposium on rock mechanics; Tucson, AZ, USA (29 Jun 1987).

The Nevada Nuclear Waste Storage Investigations Project is characterizing a tuffaceous rock unit at Yucca Mountain, Nevada to evaluate its suitability for a repository for high level radioactive waste. The candidate repository horizon is a welded, devitrified tuff bed located at a depth of about 300 m in the unsaturated zone, over 100 m above the water table. Waste package environment tests are being conducted in an exploratory shaft test facility at Yucca Mountain. The status and development of these tests are described in this article.

8635 **Determination of rock fracture parameters from crack models for failure in compression.** Kemeny, J.M.; Cook, N.G.W. (Lawrence Berkeley Lab., Berkeley, CA). pp 367-374 of Rock mechanics: Proceedings of the 28th U.S. symposium. Farmer, I.W.; Daemen, J.J.K.; Desai, C.S.; Glass, C.E.; Neuman, S.P. Accord, MA; A.A. Balkema Publishers (1987). (CONF-870625—). Contract AC03-76SF00098.

From 28. U.S. symposium on rock mechanics; Tucson, AZ, USA (29 Jun 1987).

Micromechanical models for axial splitting and for shear faulting are used to investigate parameters associated with rock fracture under compressive streases. The fracture energies to create splitting fractures and shear faults are calculated using laboratory triaxial data. These energies are compared with the fracture energies for the propagation of microcracks that coalesce to form the larger scale fractures. It is found that for Westerly granite, the energies to create splitting fractures and shear faults are about three orders of magnitude greater than the energy needed to drive the tensile microcracks, due to the large amount of subsidiary crack surface area created in forming the larger scale fractures. A similar scale effect can be expected when extrapolating the laboratory results to field scale problems.

8636 **Flake mechanics, borehole breakouts and thermal spallation.** Dey, T.N.; Kranz, R.L. (Earth and Space Sciences Div., Los Alamos National Lab., NM). pp 413-420 of Rock mechanics: Proceedings of the 28th U.S. symposium. Farmer, I.W.; Daemen, J.J.K.; Desai, C.S.; Glass, C.E.; Neuman, S.P. Accord, MA; A.A. Balkema Publishers (1987). (CONF-870625—).

From 28. U.S. symposium on rock mechanics; Tucson, AZ, USA (29 Jun 1987).

Rock failure due to high compressive stresses parallel to a free surface is important in forming borehole breakouts and when a rock surface is heated rapidly as in thermal spallation drilling. The rock breaks away in the form of thin flakes or spalls. The authors develop a theory which assumes a uniaxial splitting mechanism. Splitting fractures parallel to the free surface grow until a buckling condition is reached and the flake breaks away from the rock mass. The thickness of these flakes is about 1/10 to 1/20 of the other dimensions. The width to length ratio of these flakes is predicted to be about $1/\sqrt{3}$ when one of the principal stresses parallel to the free surface is zero. These results are in good agreement with laboratory experiments on specially designed test samples.

8637 **Rationale for development of constitutive models of a basalt rock mass for design of a nuclear waste repository at the Hanford Site.** Donovan, K.S.; Lehmann, G.A.; Pearce, R.S.; Kim, K. (Rockwell Hanford Operations, Richland, WA). pp 715-724 of Rock mechanics: Proceedings of the 28th U.S. symposium. Farmer, I.W.; Daemen, J.J.K.; Desai, C.S.; Glass, C.E.; Neuman, S.P. Accord, MA; A.A. Balkema Publishers (1987). (CONF-870625—).

From 28. U.S. symposium on rock mechanics; Tucson, AZ, USA (29 Jun 1987).

The Cohassett basalt flow underlying the Hanford Site in Eastern Washington is being investigated by the U.S. Department of Energy to assess the feasibility of constructing the nation's first nuclear waste repository in the flow. Development of constitutive laws of the basalt is necessary for modeling studies used to evaluate the repository design and to evaluate the ability of the repository to contain radioactive waste for several thousands of years. This paper evaluates four analytical approaches that have been used in previous analyses of the repository in basalt and presents a strategy for further development of constitutive models.

8638 **Analysis of in situ stress at Yucca Mountain.** Bauer, S.J.; Holland, J.F. (Sandia National Labs., Albuquerque, NM). pp 707-714 of Rock mechanics: Proceedings of the 28th U.S. symposium. Farmer, I.W.; Daemen, J.J.K.; Desai, C.S.; Glass, C.E.; Neuman, S.P. Accord, MA; A.A. Balkema Publisherr (1987). (CONF-870625—). Contract AC04-76DP00789.

From 28. U.S. symposium on rock mechanics; Tucson, AZ, USA (29 Jun 1987).

A method has been developed utilizing far-field finite element models such that the measured in situ stress state appears to be reproduced well. The method includes use of the mechanical stratigraphy, effective and total stresses, gravity loading, a horizontal compressive component of stress, and use of a compliant-joint rock model to calculate the mechanical response. Topographic effects and effects related to the vertical variation in mechanical properties are predicted for repository depths (— 300 m). Gravity loading with a small horizontal compression are used to calculate a minimum horizontal total stress similar in magnitude to that measured in situ.

8639 **A proposed method for predicting rock-mass deformability using a compliant joint model.** Bauer, S.J.; Conley, C.H. (Sandia National Labs., Albuquerque, NM). pp 691-698 of Rock mechanics: Proceedings of the 28th U.S. symposium. Farmer, I.W.; Daemen, J.J.K.; Desai, C.S.; Glass, C.E.; Neuman, S.P. Accord, MA; A.A. Balkema Publishers (1987). (CONF-870625—). Contract AC04-76DP00789.

From 28. U.S. symposium on rock mechanics; Tucson, AZ, USA (29 Jun 1987).

A method to predict the stress-strain response of a fractured rock mass is presented. The method involves using a finite element model as a numerical testing apparatus such that variations in rock-mass deformability properties can be calculated as a function of load level and direction. Results for the particular tuff unit studied suggest that the stress-strain behavior of the unit is anisotropic and stress-dependent.

8640 **Effects of mesh size and boundary conditions on creep analysis of rock salt.** Nipp, H.K.; Mc Nulty, E.G. (Federal Institute for Geosciences and Natural Resources, Hannover). pp 653-662 of Rock mechanics: Proceedings of the 28th U.S. symposium. Farmer, I.W.; Daemen, J.J.K.; Desai, C.S.; Glass, C.E.; Neuman, S.P. Accord, MA; A.A. Balkema Publishers (1987). (CONF-870625—).

From 28. U.S. symposium on rock mechanics; Tucson, AZ, USA (29 Jun 1987).

Mesh size, various boundary conditions, and considered time period affect prediction of creep closure around an open borehole in salt. Also, the use of finite elements near the boundary with an equivalent stiffness can significantly improve the accuracy of a solution at reduced computational cost.

8641 **Numerical simulation of drift response in rock salt resulting from the emplacement of RH-TRU waste in an array of horizontal long boreholes in a separate panel at the WIPP.** Arguello, J.G.; Beraun, R. (Sandia National Labs., Albuquerque, NM). pp 643-652 of Rock mechanics: Proceedings of the 28th U.S. symposium. Farmer, I.W.; Daemen, J.J.K.; Desai, C.S.; Glass, C.E.; Neuman, S.P. Accord, MA; A.A. Balkema Publishers (1987). (CONF-870625—).

From 28. U.S. symposium on rock mechanics; Tucson, AZ, USA (29 Jun 1987).

A series of thermal/structural analyses were performed to assess the feasibility of the Horizontal Long Borehole Concept for the emplacement of Remote Handled Transuranic waste at the Waste Isolation Pilot Plant. Results from the study indicate a strong sensitivity to power output per canister and to borehole spacing. This suggests that the feasibility of implementing the concept at the site will be highly dependent on the maximum power output per canister and on the spacing at which the boreholes containing these canisters might be placed.

8642 **Coupled brine migration and stress analysis for repository room saturation in bedded salt.** Niou, S.; Pietz, J.M. (International Technology Corp., Albuquerque, NM). pp 601-608 of Rock mechanics: Proceedings of the 28th U.S. symposium. Farmer, I.W.; Daemen, J.J.K.; Desai, C.S.; Glass, C.E.; Neuman, S.P. Accord, MA; A.A. Balkema Publishers (1987). (CONF-870625—).

From 28. U.S. symposium on rock mechanics; Tucson, AZ, USA (29 Jun 1987).

The Waste Isolation Pilot Plant (WIPP) is a transuranic nuclear waste repository mined out of Permian-age, bedded salt in southeastern New Mexico. Since excavation, small amounts of brine have been seeping into repository rooms under the influence of large pressure gradients. During the isolation period, the accumulation of brine in the room involves the coupled mechanisms of brine flow, salt creep, and room contents consolidation and pressurization. This preliminary analysis tested the qualitative importance of the coupled mechanisms using an idealized room geometry and available salt property data from the WIPP site. The computer code used and results are discussed.

8643 **Laboratory investigations of coupled stress-deformation-hydraulic flow in a natural rock fracture.** Sundaram, P.N.; Watkins, D.J.; Ralph, W.E. (Bechtel Civil Inc., San Francisco, CA). pp 585-592 of Rock mechanics: Proceedings of the 28th U.S. symposium. Farmer, I.W.; Daemen, J.J.K.; Desai, C.S.; Glass, C.E.; Neuman, S.P. Accord, MA; A.A. Balkema Publishers (1987). (CONF-870625—).

From 28. U.S. symposium on rock mechanics; Tucson, AZ, USA (29 Jun 1987).

Radial flow tests under several cycles of normal load were performed on a natural fracture in a 0.914m diameter granite cylinder. The flowrate exhibited transient characteristics in spite of constant applied water pressure. The estimated steady-state unit flowrate was found to decrease with increase in effective normal stress. Fundamental parameters that affect the flowrate include the contact area, roughness and the area available for flow. Past studies have shown that laminar hydraulic flow in a plane fracture is proportional to the cube of aperture size (parallel plate model). However, the constant of proportionality is a function of roughness and the contact area which themselves are functions of the stress-history of the fracture. By introducing a factor to account for these effects, the cubic law may still be applied. A simple physical justification for the modifying factor is explained.

8644 **Fracture flow response to applied stress: A field study.** Sour, L.; Ubbes, W. (Colorado School of Mines, Golden, CO). pp 501-508 of Rock mechanics: Proceedings of the 28th U.S. symposium. Farmer, I.W.; Daemen, J.J.K.; Desai, C.S.; Glass, C.E.; Neuman, S.P. Accord, MA; A.A. Balkema Publishers (1987). (CONF-870625—).

From 28. U.S. symposium on rock mechanics; Tucson, AZ, USA (29 Jun 1987).

A series of experiments that measured the mechanical and hydrological responses of a single natural fracture under controlled stress conditions in-situ has been performed at the Colorado School of Mines (CSM). It is part of a widespread research effort supporting the performance assessment of nuclear waste repositories in crystalline rock. The fracture experiments are described. The results from first-stage permeability analysis of the normal compression tests exhibit some expected trends, such as stiffening of the fracture under increasing load, but also indicate that fluid flow in a natural fracture is a complex issue not easily characterized by any single equation.

8645 **Influence of stress-induced deformations on observed water flow in fractures of the Climax Granitic Stock.** Wilder, D.G. (Lawrence Livermore National Lab.). pp 491-500 of Rock mechanics: Proceedings of the 28th U.S. symposium. Farmer, I.W.; Daemen, J.J.K.; Desai, C.S.; Glass, C.E.; Neuman, S.P. Accord, MA; A.A. Balkema Publishers (1987). (CONF-870625—). Contract W-7405-ENG-48.

From 28. U.S. symposium on rock mechanics; Tucson, AZ, USA (29 Jun 1987).

Three examples of stress induced influence on fracture dominated hydrology were noted in drifts 1400 ft below surface in granite. Seepage into portions of shears near a fault zone and an adjoining drift, and mineralization of the joints were the three indicators of shear stress. Interpretation of these results are given.

8646 **Some recent developments in understanding the hydrology of fractured rocks.** Witherspoon, P.A.; Long, J.C.S. (Earth Sciences Div., Lawrence Berkeley Lab., Univ. of California). pp 421-432 of Rock mechanics: Proceedings of the 28th U.S. symposium. Farmer, I.W.; Daemen, J.J.K.; Desai, C.S.; Glass, C.E.; Neuman, S.P. Accord, MA; A.A. Balkema Publishers (1987). (CONF-870625—). Contract AC03-76SF00098.

From 28. U.S. symposium on rock mechanics; Tucson, AZ, USA (29 Jun 1987).

Current research on fracture hydrology at Lawrence Berkeley Laboratory is focused on two scales: the single fracture and fracture networks. In the area of single fractures, the authors have established a research program aimed at characterizing the geometry of the void spaces, using metal casts and mercury injection to elucidate details of the complex geometry that result as a fracture closes under stress. With this geometry, the flow regime is being

examined using an approach based on Navier-Stokes equations. Three techniques are being used to investigate the geometry of fracture networks: statistical analysis of observed field data; geophysical techniques for seeing into the rock; and prediction of fracture patterns through the application of rock mechanics. The focus of statistical analysis, new techniques for comparing results of seismic tomography with fracture properties controlling flow, shear zones and new models are discussed.

8647 **Fracture detection using subsurface electromagnetic techniques.** Zhou, Q.; Becker, A.; Goldstein, N.E.; Morrison, H.F.; Lee, K.H. (Dept. of Material Science and Mineral Engineering, Univ. of California, Berkeley, CA). pp 5-18 of Rock mechanics: Proceedings of the 28th U.S. symposium. Farmer, I.W.; Daemen, J.J.K.; Desai, C.S.; Glass, C.E.; Neuman, S.P. Accord, MA; A.A. Balkema Publishers (1987). (CONF-870625—).

From 28. U.S. symposium on rock mechanics; Tucson, AZ, USA (29 Jun 1987).

Audio frequency subsurface electromagnetic (EM) techniques using cross-hole and in-hole arrays for fracture detection are evaluated numerically. The fracture zone is represented by a thin rectangular conductor with finite dimensions, embedded in a conductive host rock. Because of its practical advantages, the EM source considered in this study is a grounded vertical electrical dipole (G.V.E.D.) placed in a vertical bore hole. Three source-receiver configurations are considered. The first is the cross-hole configuration with the source and receiver moving parallel to each other in separate holes. The second configuration is a fixed source in one hole and a moving receiver in the other. Finally, the author also treat the case of a tandem source and receiver at fixed separation traversing a single hole. In all cases the conductive fracture zone is not intersected by either hole. Comparisons between the grounded electric dipole and the vertical magnetic dipole indicate clear advantages for the former.

8648 **Electromagnetic experiment to map in situ water in heated welded tuff: Preliminary results.** Ramirez, A.L.; Daily, W.D. (Lawrence Livermore National Lab., CA). pp 37-46 of Rock mechanics: Proceedings of the 28th U.S. symposium. Farmer, I.W.; Daemen, J.J.K.; Desai, C.S.; Glass, C.E.; Neuman, S.P. Accord, MA; A.A. Balkema Publishers (1987). (CONF-870625—). Contract W-7405-ENG-48.

From 28. U.S. symposium on rock mechanics; Tucson, AZ, USA (29 Jun 1987).

The results of an experiment conducted in Tunnel Complex G at the Nevada Test Site to evaluate geotomography as a possible candidate for in situ monitoring of hydrology in the near field of a heater placed in densely welded tuff are given. The experiment is described. The linear character of many tomographic features and their spatial correlation with fractures mapped in boreholes are evidence that drying was most rapid along some fractures. The interpretation of the tomographs is preliminary until they can be processed without the restrictive assumption of straight ray paths for the signals through the highly heterogeneous rock mass.

8649 **Elastic properties of dry, highly porous tuffs.** Butcher, B.M. (Sandia National Labs., Albuquerque, NM). pp 181-188 of Rock mechanics: Proceedings of the 28th U.S. symposium. Farmer, I.W.; Daemen, J.J.K.; Desai, C.S.; Glass, C.E.; Neuman, S.P. Accord, MA; A.A. Balkema Publishers (1987). (CONF-870625—). Contract AC04-76DP00789.

From 28. U.S. symposium on rock mechanics; Tucson, AZ, USA (29 Jun 1987).

A functional relationship between values for the elastic constants and porosity has been developed for tuffs with various degrees of welding. This correlation defines the change in elastic constants with inelastic compaction for wave propagation analysis and also can be used to estimate elastic properties of tuffs with different initial porosity. The ability to relate stress induced changes to unstressed states with different porosity values is new and eliminates the need for a large, costly testing program every time the site changes.

8650 **Laboratory investigation of crushed salt consolidation.** Case, J.B.; Withiam, J.L.; Kelsall, P.C. (IT Corp., Albuquerque, NM). pp 189-196 of Rock mechanics: Proceedings of the 28th U.S. symposium. Farmer, I.W.; Daemen, J.J.K.; Desai, C.S.; Glass, C.E.; Neuman, S.P. Accord, MA; A.A. Balkema Publishers (1987). (CONF-870625—).

From 28. U.S. symposium on rock mechanics; Tucson, AZ, USA (29 Jun 1987).

The safe geologic isolation of nuclear wastes in an underground repository and requires sealing access shafts and drifts for long periods. Crushed salt backfill is being investigated as a potential backfill and seal material through laboratory testing to determine how fundamental properties such as permeability, porosity and creep rate are reduced by pressure and time through consolidation. The test program reported in this paper consisted of four consolidation tests using crushed salt obtained from the Waste Isolation Pilot Plant and the Avery Island Mine. The tests conducted, and the results including volumetric creep strain rate are given.

8651 **Planning a program in experimental rock mechanics for the Nevada Nuclear Waste Storage Investigations Project.** Blejwas, T.E. (Sandia National Labs., Albuquerque, NM). pp 1043-1052 of Rock mechanics: Proceedings of the 28th U.S. symposium. Farmer, I.W.; Daemen, J.J.K.; Desai, C.S.; Glass, C.E.; Neuman, S.P. Accord, MA; A.A. Balkema Publishers (1987). (CONF-870625—). Contract AC04-76DP00789.

From 28. U.S. symposium on rock mechanics; Tucson, AZ, USA (29 Jun 1987).

The next phase of the Nevada Nuclear Waste Storage Investigations (NNWSI) Project is the characterization of Yucca Mountain, a possible site for a high-level nuclear-waste repository. Site characterization includes experimental programs in many technical fields, including rock mechanics. The planning approach includes performance allocation, an interactive process by which the data needs for design and performance assessment of the repository are used to determine the direction and magnitude of the experimental programs.

8652 **Inhibiting localized corrosion during storage of dilute SRP wastes.** Oblath, S.B.; Congdon, J.W. (E.I. du Pont de Nemours and Co., Savannah River Lab., Aiken, SC 29808). pp 599-602 of Waste management '87: Waste isolation in the US, technical programs, and public education. Post, R.G. Tucson, AZ; University of Arizona Nuclear Engineering Dept. (1987). (CONF-870306—).

From Waste management '87; Tucson, AZ, USA (1 Mar 1987).

High-level radioactive waste will be incorporated in borosilicate glass in the Defense Waste Processing Facility (DWPF) at the Savannah River Plant (SRP). As part of this process, large volumes of inorganic salt wastes are decontaminated for disposal as low-level waste. The principal contaminants, /sup 137/Cs and /sup 90/Sr, are removed by treatment with sodium tetraphenylborate and sodium titanate. The resulting solids are slurried with a dilute salt solution and stored in existing carbon steel tanks for several years prior to processing and disposal. Initial test indicated a tendency for localized corrosion of the tanks. An investigation, using nonradioactive simulants for the expected solution compositions, identified inhibitors which would protect the steel. Changes in solution compositions over time, due to radiolytic effect, were also accounted for by the simulants. The effects these inhibitors would have on later processing steps in the DWPF were then evaluated.

8653 **Interim high level radioactive waste storage at the Idaho Chemical Processing Plant.** Eberle, A.R.; Bodner, S.S. (Westinghouse Idaho Nuclear Co., Inc., Idaho Falls, ID 83403). pp 609-614 of Waste management '87: Waste isolation in the US, technical programs, and public education. Post, R.G. Tucson, AZ; University of Arizona Nuclear Engineering Dept. (1987). (CONF-870306—).

From Waste management '87; Tucson, AZ, USA (1 Mar 1987).

Storage facilities, referred to as bin sets, are provided for the interim storage of the granular solid radioactive waste produced at the Idaho Chemical Processing Plant. Each bin set provides com-

plete isolation of the waste from the environment by a double containment system. This paper describes the bin sets, including retrieval lines, vent and relief system, and transport and fill system. Also described are the cooling air system, the vent and relief system, retrieval systems and radiation monitors are discussed.

8654 **Preliminary preclosure safety analysis for a prospective Yucca mountain repository.** Jardine, L.J.; Ma, C.W.; Sit, R.C.; Donahue, R.J. (Bechtel National Inc., Advanced Technology, San Francisco, CA 94119). pp 645-650 of Waste management '87: Waste isolation in the US, technical programs, and public education. Post, R.G. Tucson, AZ; University of Arizona Nuclear Engineering Dept. (1987). (CONF-870306—).

From Waste management '87; Tucson, AZ, USA (1 Mar 1987).

A quantitative probabilistic safety assessment was performed for the reference conceptual repository design being used as the basis for the development of the Yucca Mountain Site Characterization Plan. A new methodology to quantify radioactive source terms for the air pathways was also developed and applied in the assessment. The assessment identified 21 potential initiating internal and external events applicable to the prospective site for which 149 potential accident scenarios were defined with event tree analysis. Of these accident scenarios, 13 occurred with probabilities ranging between 10/sup -6/ to 10/sup -9/ per year and with estimated offsite 50-year dose commitment consequences ranging from 110 to 1,100 mrem, respectively. These 13 reference accident scenarios represent the most severe consequences identified that the operation of a repository could initiate. The remaining scenarios had either probabilities of occurrence of less than 5 x 10/sup -9/ per year or offsite dose consequences of less than 50 mrem.

8655 **Quality assurance records system for research and development activities in support of geologic repository programs.** Smith, J.W.; Ryder, D.E. (Pacific Northwest Lab., Richland, WA 99352). pp 685-690 of Waste management '87: Waste isolation in the US, technical programs, and public education. Post, R.G. Tucson, AZ; University of Arizona Nuclear Engineering Dept. (1987). (CONF-870306—).

From Waste management '87; Tucson, AZ, USA (1 Mar 1987).

The Pacific Northwest Laboratory (PNL), which is operated by Battelle Memorial Institute for the Department of Energy, is conducting various studies associated with the high-level waste repository site selection process. In conjunction with this effort, PNL has developed a quality assurance (QA) program that is applicable to all organizations that are performing research and development (R and D) activities in support of the repository programs. This QA program meets the basic and supplemental requirements of ANSI/ASME NQA-1-1983 and the Nuclear Regulatory Commission (NRC) Review Plan for QA Programs for Site Characterization of High Level Nuclear Waste Repositories. A key part of this program is the handling of QA records that may ultimately support the licensing process for the repository. This paper describes a QA records system that is flexible enough to accommodate several types of research, such as paper studies, test method development, site characterization studies, software development, and hardware design.

8656 **TMI-2: Unique waste management technology.** Bixby, W.W.; Young, W.R.; Grant, P.J. (Idaho National Engineering Lab.). pp 17-22 of Waste management '87: Waste isolation in the US, technical programs, and public education. Post, R.G. Tucson, AZ; University of Arizona Nuclear Engineering Dept. (1987). (CONF-870306—).

From Waste management '87; Tucson, AZ, USA (1 Mar 1987).

The 1979 accident at TMI-2 severely damaged the reactor core and contaminated more than a million gallons of water. Subsequent activities created another million gallons of water. The damaged reactor core represented a new waste form and cleanup of the contaminated water and system components created other new waste forms requiring creative approaches to waste management. This paper focuses on technologies that were developed specific to fuel waste management, core debris shipping, processing accident generated water, and disposal of the resultant waste forms.

8657 **Tale of two repositories.** Mc Nulty, J. pp 3-6 of Waste management '87: Waste isolation in the US, technical programs, and public education. Post, R.G. Tucson, AZ; University of Arizona Nuclear Engineering Dept. (1987). (CONF-870306—).

From Waste management '87; Tucson, AZ, USA (1 Mar 1987).

This paper reviews the history of the West and East proposed siting of the two HLW repositories and of the conflict between USDOE and Congress over the secondary repository (in the east). The author sums up the paper with a call for resignation of the Secretary of Energy.

8658 **The Low-Level Radioactive Waste Policy Amendments Act of 1985 milestones: Surcharge rebates, escrow account administration and compliance determination.** Smiley, J.L.; Tullis, J.A.; Fraas, T.B. (U.S. Dept. of Energy, Washington, DC). pp 59-62 of Waste management '87: Waste isolation in the US, technical programs, and public education. Post, R.G. Tucson, AZ; University of Arizona Nuclear Engineering Dept. (1987). (CONF-870306—).

From Waste management '87; Tucson, AZ, USA (1 Mar 1987).

The Department of Energy (DOE) published a Notice of Inquiry in the Federal Register seeking comment on the DOE proposed criteria for compliance with the 1988 milestone. The notice sets forth the procedures by which the nonmember states and nonsited compact regions must submit documentation of compliance and request rebates, and by which DOE will determine compliance.

8659 **The draft Mission Plan Amendment.** Gale, R.W. (Office of Civilian Radioactive Waste Management, U.S. Dept. of Energy). pp 47-52 of Waste management '87: Waste isolation in the US, technical programs, and public education. Post, R.G. Tucson, AZ; University of Arizona Nuclear Engineering Dept. (1987). (CONF-870306—).

From Waste management '87; Tucson, AZ, USA (1 Mar 1987).

The draft Mission Plan Amendment provides an opportunity for States and Indian Tribes and other involved parties to participate in a process that no other nation affords its citizens. More than just a comment period on a Department of Energy document, the amendment that is to be submitted later this year will lay before Congress, the documentary basis on which to make decisions about the scope and timing of the high-level waste program in what Secretary Herrington has called a "crossroads" years. The Amendment will distill the view of the participants and also preset them to Congress as an integral part of the document. After four years of effort, the Nation is being afforded an opportunity to ask itself again whether the Act passed in 1982 is working and remains the best way to protect the public interest.

8660 **Selected issues affecting Indian tribes in the implementation of the NWPA.** Sampson, M. (Yakima Indian Nation, Toppenish, WA 98948). pp 29-30 of Waste management '87: Waste isolation in the US, technical programs, and public education. Post, R.G. Tucson, AZ; University of Arizona Nuclear Engineering Dept. (1987). (CONF-870306—).

From Waste management '87; Tucson, AZ, USA (1 Mar 1987).

Enactment of the NWPA requires that a candidate site is selected for the first high-level waste (HLW) repository based on a formal comparative evaluation of the three sites under characterization as approved by the U.S. President. However, the nominated sites can only be compared with one another if there is such a common basis for scientific judgment. The development of such a scientific basis prior to the start-up of site characterization activities entails several important issues which potentially affect the rights of the Indian Tribes. This paper describes the issues.

8661 **Fixation of high-level wastes in glasses.** Mendel, J.E. (Pacific Northwest Lab., Richland, WA, USA). *Philosophical Transactions of the Royal Society of London, Series A: Mathematical and Physical Sciences;* **319**: No. 1545, 49-62(30 Jul 1986).

A plant for the fixation of high-level wastes in borosilicate glass has been operating in France since 1978. A large plant is under construction in the U.S. for the fixation of defence high-level waste and plans for other glass fixation plants are well advanced at several sites around the world. Among the reasons for the selection of borosilicate glass as a fixation medium are the relative ease of processing wastes of variable composition by means of well established technology, and the long-term radiation and thermal stability of the glass. Well formulated glass also has sufficient resistance to the action of groundwater so that it can serve as an important barrier against the spread of radionuclides via groundwater in any forseeable situation. Research is continuing to quantify the reactions of waste glass in site-specific geological repository environments.

8662 Geochemical and environmental processes affecting radionuclide migration from a formerly used seepage trench. Olsen, C.R.; Lowry, P.D.; Lee, S.Y.; Larsen, I.L.; Cutshall, N.H. (Oak Ridge National Lab., TN, USA). *Geochimica et Cosmochimica Acta;* **50**: No. 4, 593-607(Apr 1986).

The disposal of liquid waste, containing about 0.3 million curies (10^7 GBq) of fission nuclides, activation products, actinides and transuranics, in a shallow land seepage trench from 1962 to 1966, provided a field opportunity for investigating the chemical, geological, and hydrological processes which affect contaminant migration in soils and weathered bedrock. Gamma-log profiles of wells near the trench indicate that the waste liquids seeped along discrete layers parallel to bedding and along the strikes of faults and folds. Most of the radioactivity measured in the groundwaters consisted of ^{3}H, ^{99}Tc, ^{60}Co, and ^{233}U. The mobility of ^{99}Tc, ^{60}Co, and ^{233}U has been attributed to low molecular weight anionic complexing. Concentrations of ^{90}Sr and ^{137}Cs in the groundwaters were extremely low because of the chemical treatments and precautions taken to establish and maintain an alkaline environment near the trench, which allows for ^{90}Sr sorption and precipitation, and because of the strong tendency for ^{137}Cs to be selectively sorbed by illite. Plutonium isotopic ratios indicate that much of the plutonium contamination near the trench results from the migration of ^{242}Cm and ^{244}Cm and their subsequent decay to ^{238}Pu and ^{240}Pu. Radionuclide concentrations in the groundwaters near the north end of the trench undergo seasonal variations, with the highest activities occurring in the spring and after prolonged rainfall. This suggests that contamination may be leached from the trench or from the relict waste migration layers when the groundwater level rises to saturate these zones or when precipitation infiltrates into the trench or along these relict migration layers during drainage. Suspected transport pathways from the trench to a nearby seep area appear to be associated with fault zones and limbs of a plunging limestone fold.

8663 Glass containing radioactive nuclear waste. Boatner, L.A.; Sales, B.C. (to Department of Energy, Washington, DC, USA). British Patent 2157675/A/. 30 Oct 1985. Priority date 11 Apr 1984, United States of America (USA), 11p. Patent Office, 25 Southampton Buildings, London, WC2A 1AY.

US priority 599111.

Lead-iron phosphate glasses containing a high level of Fe_2O_3 for use as a storage medium for high-level-radioactive nuclear waste. By combining lead-iron phosphate glass with various types of simulated high-level nuclear waste, a highly corrosion resistant, homogeneous, easily processed glass can be formed. For corroding solutions at 90 C, with solution pH values in the range between 5 and 9, the corrosion rate of the lead-iron phosphate nuclear waste glass is at least 10^2 to 10^3 times lower than the corrosion rate of a comparable borosilicate nuclear waste glass. The presence of Fe_2O_3 in forming the lead-iron phosphate glass is critical. Lead-iron phosphate nuclear waste glass can be prepared at temperatures as low as 800 C, since they exhibit very low melt viscosities in the 800 to 1050 C temperature range. These waste-loaded glasses do not readily devitrify at temperatures as high as 550 C and are not adversely affected by large doses of gamma radiation in H_2O at 135 C. The lead-iron phosphate waste glasses can be prepared with minimal modification of the technology developed for processing borosilicate glass nuclear waste forms.

8664 U.S. Department of Energy high-level nuclear waste repository program. Groundwater concerns in Texas. Frishman, S. (Nuclear Waste Program Office, Office of the Governor, State of Texas). pp 353-360 of Issues in groundwater management. Smerdon, E.T.; Jordon, W.R. Austin, TX; Center for Research in Water Resources (1985). (CONF-8410468—).

From 12. symposium on issues in groundwater management; San Antonio, TX, USA (29 Oct 1984).

The U.S. Department of Energy (DOE) has been carrying out investigations in the Texas Panhandle since the late 1970s as part of a national program seeking to site a high-level nuclear waste repository for permanent disposal of the highly radioactive wastes resulting from operation of nuclear powered electrical generation plants. It also appears that the repository will be used for disposal of solidified radioactive wastes, now being stored in liquid form, from the nation's nuclear weapons programs. In 1980, deep geologic disposal of these long half-life radioactive wastes was established as the preferred method, and with the January 1983 enactment of the federal Nuclear Waste Policy Act, DOE elected to continue investigation of nine sites in the nation which were determined by the secretary of energy to be potentially acceptable as repository sites.

0530 Environmental Aspects

REFER ALSO TO CITATION(S) 8538, 8539, 8543, 8545, 8546, 8547, 8548, 8551, 8552, 8553, 8554, 8555, 8556, 8578, 8580, 8589, 8592, 8594, 8596, 8597, 8598, 8599, 8602, 8603, 8604, 8605, 8606, 8607, 8608, 8609, 8610, 8611, 8612, 8613, 8614, 8615, 8616, 8617, 8618, 8619, 8620, 8621, 8622, 8623, 8624, 8625, 8626, 8630, 8631, 8925, 9853

8665 (SAND—87-1477C) Force control of a robot for surface contamination detection. Petterson, B.J.; Jones, J.F. (Sandia National Labs., Albuquerque, NM (USA)). 1987. Contract AC04-76DP00789. 4p. (CONF-871101—71). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88003006/JAW.

From Joint meeting of the American Nuclear Society and the Atomic Industrial Forum; Los Angeles, CA, USA (15 Nov 1987).

A system is under development at Sandia National Laboratories for use in understanding the issues relating to automated robotic handling of spent nuclear fuel shipping casks. The goal of robotic handling is reduction of personnel radiation exposure at the proposed geologic repositories. One of the major technology development areas has been the integration of sensors into the control of the robot system to allow operation in semi-structured environments. In particular, a multiaxis force sensor is used to make robot trajectory corrections based on the contact force between the robot and workpiece. This force feedback system allows contact swipes (smears) to be made on the cask surface in a repeatable manner. 8 refs., 3 figs.

0540 Health And Safety

REFER ALSO TO CITATION(S) 8478, 8552, 8602, 9287, 9768, 9852, 9853, 9854, 9873, 9878, 9880, 9881

8666 (INIS-mf—11048, pp 168-169) Attempt for dismantle of ventilation pipelines contaminated with long-living radionuclides. Vyrbanov, P.; Pironkov, A. (Meditsinska Akademiya, Sofia, Bulgaria. Nauchen Inst. po Rentgenologiya i Radiobiologiya). Oct 1985. (In Bulgarian). NTIS (US Sales Only), PC A09/MF A01. Order Number DE88780035/JAW. (CONF-8510479—).

From 6. national congress of roentgenology, radiology and radiobiology; Sofia, Bulgaria (4 Oct 1985).

8667 (INIS-mf—11054, pp 37) Measurement of radioactive burden of meat and live animals by thermoluminiscent dosimeters. Schoener, W.; Vana, N. (Atominstitut der Oesterreichischen Universitaeten, Vienna). Sep 1987. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88700772/JAW. (CONF-8709196—).

From Annual convention fo the Austrian Physical Society; Vienna, Austria (21 Sep 1987).

0550 Safeguards, Inspection, And Accountability

REFER ALSO TO CITATION(S) 8557, 8851, 9193, 9288

8668 (CONF-870713—61) Systems analysis for materials control and accountancy technology. Daly, T.A.; Bucher, R.G.; Rothman, A.B.; Charak, I.; Persiani, P.J. (Argonne National Lab., IL (USA)). 1987. Contract W-31109-ENG-38. 7p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE88002913/JAW.

From 28. INMM annual meeting on safeguards: a mature technology; Newport Beach, CA, USA (12 Jul 1987).

The objective of this study is to upgrade Materials Control and Accountancy (MC and A) technology over the flows of special nuclear materials throughout the DOE complex of fuel cycles. The program focus is to develop a "Management Tool" for decision support in evaluating MC and A upgrades, and in validating the MC and A aspects of the Master Safeguards and Security Agreements (MSSA) effectiveness. The approach is the computerization of the nuclear materials flow charts, identification of key measurement locations in the production and product fuel cycle, and construct data information processing at each measurement location. The program is to provide the Office of Safeguards and Security (OSS) with a timely management decision support system in planning MC and A safeguards technology upgrades over the nuclear materials production and product cycles.

8669 (DP-MS—87-102) Development of a generic, computerized nuclear material accountability system: NucMAS. Cornell, M.D.; O'Leary, J.M. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Plant). 1987. Contract AC09-76SR00001. 6p. (CONF-871231—1). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88002437/JAW.

From American Nuclear Society topical conference; San Diego, CA, USA (1 Dec 1987).

The application NucMAS provides basic computerized accountability functions for the Savannah River Plant (SRP) Separations Department Material Balance Areas (MBA's). These functions include data entry, data management, calculations, and report generation. NucMAS can be used both for routine reporting to the SRP central Material Control and Accounting (MC and A) system and for rapid ad hoc queries in emergency situations. The system is designed to work with any process handling one or more of the 17 accountable nuclear materials specified by the Department of Energy (DOE). It relies on user-supplied configuration data to drive data prompts, report headings, data validations, and calculations.

8670 (LA-UR—87-3739) Stationary and protable instruments for assay of HEU [highly enriched uranium] solids holdup. Russo, P.A.; Sprinkle, J.K. Jr.; Stephens, M.M.; Brumfield, T.L.; Gunn, C.S.; Watson, D.R. (Los Alamos National Lab., NM (USA); Oak Ridge Y-12 Plant, TN (USA)). 1987. Contract W-7405-ENG-36. 16p. (CONF-871110—10). NTIS, PC A03. Order Number DE88003172/JAW.

From 3. international conference on facility operations safeguards interface; San Diego, CA, USA (29 Nov 1987).

Two NaI(Tl)-based instruments, one stationary and one portable, designed for automated assay of highly enriched uranium (HEU) solids holdup, are being evaluated at the scrap recovery facility of the Oak Ridge Y-12 Plant. The stationary instrument, a continuous monitor of HEU within the filters of the chip burner exhaust system, measures the HEU deposits that accumulate erratically and rapidly during chip burner operation. The portable system was built to assay HEU in over 100 m of elevated piping used to transfer UO_3, UO_2, and UF_4 powder to, from, and between the fluid bed conversion furnances and the powder storage hoods. Both instruments use two detector heads. Both provide immediate automatic readout of accumulated HEU mass. The 186-keV ^{235}U gamma ray is the assay signature, and the 60-keV gamma ray from an ^{241}Am source attached to each detector is used to normalize the 186-keV rate. The measurement geometries were selected for compatibility with simple calibration models. The assay calibrations were calculated from these models and were verified and normalized with measurements of HEU standards built to match geometries of uniform accumulations on the surfaces of the process equipment. This instrumentation effort demonstrates that simple calibration models can often be applied to unique measurement geometries, minimizing the otherwise unreasonable requirements for calibration standards and allowing extension of the measurements to other process locations.

8671 (LA-UR—87-3966) Experience of developing an integrated nondestructive assay system. Hsue, S.T.; Baker, M.P. (Los Alamos National Lab., NM (USA)). 1987. Contract W-7405-ENG-36. 7p. (CONF-871110—7). NTIS, PC A02. Order Number DE88003149/JAW.

From 3. international conference on facility operations safeguards interface; San Diego, CA, USA (29 Nov 1987).

A consortium of national laboratories is collaborating with the Savannah River Plant to develop an integrated system of state-of-the-art nondestructive assay (NDA) instrumentation to provide nuclear materials accounting and process control information for a new plutonium scrap recovery facility. Individual microcomputer-based instruments report assay results to an instrument control computer (ICC). The ICC, in turn, is part of a larger computer network that includes computers that perform process control and nuclear materials accounting functions. The experience in developing the integrated NDA system, the design, and the testing are discussed.

8672 (ND-R—1275(R)) Computerised accountancy system (MYDAS) for irradiated components in RNL's Mayfair Laboratory at Culcheth. Stansfield, R.G.; Baker, A.R. (UKAEA Risley Nuclear Power Development Establishment). Sep 1985. 27p. H.M. Stationery Office, London; price Pound 4.00.

The computerised Mayfair Accountancy System (MYDAS) has been developed to account for irradiated components in the Mayfair Laboratory at Culcheth and supersedes a card-index system. The computerised system greatly improves the availability of the data held and it ensures, by means of extensive data validation programs, that the data accurately represent the current inventory of irradiated components in the Laboratory. The system has been implemented on the Risley ICL 2966 main-frame computer and uses an IDMS database to store the data. The computer is accessed through the facilities of the Transaction Processing Management System (TPMS) providing rapid and secure access to the database from several visual display units and printers simultaneously.

8673 (ORNL/TM—10627) ISPO Task A-143: Final report of an evaluation of the Finnigan-MAT THQ mass spectrometer as an on-site inspection instrument. Smith, D.H.; McKown, H.S.; Carter, J.A. (Oak Ridge National Lab., TN (USA)). Nov 1987. Contract AC05-84OR21400. 28p. (ISPO—285). NTIS, PC A03/MF A01; GPO Dep. Order Number DE88003719/JAW.

IAEA must verify proper operation of various nuclear facilities around the world. Mass spectrometry is an important analytical technique that provides both isotopic composition and total concentration of uranium and plutonium. IAEA is exploring the possibility of performing these analyses on-site. This report describes a field test of a Finnigan-MAT THQ mass spectrometer, a candidate for an on-site analytical instrument. Tests were performed at WAK, Karlsruhe. The instrument performed well and should be valuable for on-site analyses. Its performance was difficult to evaluate in some instances because of problems in sample preparation and filament loading. Since WAK presents a "worst case" situation, we are optimistic that the instrument will take its place in the arsenal of the nuclear analytical chemist.

0560 Legislation And Regulations

REFER ALSO TO CITATION(S) 8505, 8584, 8658, 8659, 8660, 8664, 9753

8674 **(IAEA-INFCIRC—254(Add.10)) Communications received from certain Member States regarding guidelines for the export of nuclear material, equipment or technology.** (International Atomic Energy Agency, Vienna (Austria)). Sep 1987. 2p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88700859/JAW.

Hard copies are available in English and French from IAEA Division of Publications, Distribution Unit.

8675 (INIS-mf—11048, pp 177) **Radiation protection optimization - quantitative approaches and methods.** Vasilev, G.; Stoilova, S. (Meditsinska Akademiya, Sofia, Bulgaria. Nauchen Inst. po Rentgenologiya i Radiobiologiya). Oct 1985. (In Bulgarian). NTIS (US Sales Only), PC A09/MF A01. Order Number DE88780035/JAW. (CONF-8510479—).

From 6. national congress of roentgenology, radiology and radiobiology; Sofia, Bulgaria (4 Oct 1985).

07 ISOTOPE AND RADIATION SOURCE TECHNOLOGY

0701 Physical Isotope Separation

REFER ALSO TO CITATION(S) 9256

8676 **(ORNL/TM—10356) Stable isotope separation in calutrons: Forty years of production and distribution.** Bell, W.A.; Tracy, J.G. (Oak Ridge National Lab., TN (USA)). Nov 1987. Contract AC05-84OR21400. 160p. NTIS, PC A08/MF A01; 1; GPO Dep. Order Number DE88003704/JAW.

The stable isotope separation program, established in 1945, has operated continually to provide enriched stable isotopes and selected radioactive isotopes, including the actinides, for use in research, medicine, and industrial applications. This report summarizes the first forty years of effort in the production and distribution of stable isotopes. Evolution of the program along with the research and development, chemical processing, and production efforts are highlighted. A total of 3.86 million separator hours has been utilized to separate 235 isotopes of 56 elements. Relative effort expended toward processing each of these elements is shown. Collection rates (mg/separator h), which vary by a factor of 20,000 from the highest to the lowest (^{205}Tl to ^{46}Ca), and the attainable isotopic purity for each isotope are presented. Policies related to isotope pricing, isotope distribution, and support for the enrichment program are discussed. Changes in government funding, coupled with large variations in sales revenue, have resulted in 7-fold perturbations in production levels.

0702 Radiation Sources

REFER ALSO TO CITATION(S) 9577, 9613, 9614

8677 (IAEA-TECDOC—428, pp 135-150) **Simultaneous DeSO/sub x/ and DeNO/sub x/ of flue gases by the EB-process in the Agate pilot plant.** Jordan, S.; Schikarski, W. (Kernforschungszentrum Karlsruhe G.m.b.H., Germany, F.R. Lab. fuer Aerosolphysik und Filtertechnik 1). Jul 1987. NTIS (US Sales Only), PC A13/MF A01. Order Number DE88700363/JAW. (CONF-8610346—).

From Consultants' meeting on electron beam processing of combustion flue gases; Karlsruhe, F.R. Germany (27 Oct 1986).

Technical details and main experiments carried out at the AGATE pilot plant installed at the Nuclear Research Centre Karlsruhe are described. The plant is designed to operate up to 1000 Nm/sup 3//h of flue gas, with various possibilities of changing the process parameter and the composition of the flue gas, and of investigating their effect on process efficiency. Experiments are also being carried out to provide a comparison with model calculations. Good agreement was achieved between experiments and calculations based on a gas phase chemistry model. Considerable efforts have been devoted to the analysis of the product aerosols and to the filtration techniques. 23 figs.

8678 **(JINR—14-86-820) Determination of depth profiles of element content by PIXE method.** Il'khamov, R.A.; Li Zen Kho; Osetinskij, G.M.; Pajek, M.; Shandrik, R. (Tashkentskij Gosudarstvennyj Univ., USSR; Joint Inst. for Nuclear Research, Dubna, USSR. Lab. of Neutron Physics). (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Neutron Physics). 1986. 10p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88700901/JAW.

Results of determination of depth profiles of element content by PIXE-analysis method is presented. 1.0-3.5 MeV /sup 1/H/sup +/ and /sup 4/He/sup +/ ion beams of the JINR electrostatic accelerator have been used. Experiments were carried out for metals and Fe/sub 50/Ni/sub 30/B/sub 20/ alloy. 17 refs.; 6 figs.; 1 tab.

0703 Isotopic Power Supplies

REFER ALSO TO CITATION(S) 9040

08 HYDROGEN

8679 **(DOE/CE—0201) Hydrogen Energy Coordinating Committee: Annual report-Summary of DOE hydrogen programs for FY 1987.** (USDOE Assistant Secretary for Conservation and Renewable Energy, Washington, DC. Office of Energy Storage and Distribution). Jan 1988. 44p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88003960/JAW.

The HECC (Hydrogen Energy Coordinating Committee) was organized to improve communications between various groups performing research related to hydrogen. The FY 1987 summary is the tenth consecutive yearly report providing an overview of the hydrogen-related programs of the DOE offices represented on the HECC. These offices include Basic Energy Sciences, Energy Storage and Distribution, Fossil Energy, Fusion Energy, Inertial Fusion, Military Application, Solar Energy, and Transportation Systems. (DLC)

0801 Production

REFER ALSO TO CITATION(S) 9215

8680 **(DOE/PC/90526—3) Partial oxidation of light alkanes in transition-metal ion containing zeolite: Quarterly report, March 15-June 14, 1987.** Klier, K.; Lin, J. (Lehigh Univ., Bethlehem, PA (USA). Dept. of Chemistry). 1987. Contract FG22-86PC90526. 14p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88002259/JAW.

First SWXα calculations have been carried out using $(Zn_4O_{11})^{-14}$ and $(Zn_9CuO_{11})^{-14}$ clusters as model for transition-metal ions in oxide matrices. Bandgap, valence band edge and valence band width can be predicted with accuracy when the Watson sphere radius is reduced to cancel the dipole moment at the cluster boundaries. 15 refs., 4 figs., 1 tab.

8681 **(LBL—23270) Water flow calorimetry measurements of heat loads for a volume production H$^-$ source.** Purgalis, P.; Ackerman, G.; Kwan, J.; Wells, R.P. (Lawrence Berkeley Lab., CA (USA)). Oct 1987. Contract AC03-76SF00098. 4p. (CONF-871007—62). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88002770/JAW.

From 12. symposium on fusion engineering; Monterey, CA, USA (12 Oct 1987).

The design of volume-production H$^-$ sources requires the knowledge of heat loads on the source components. The arc and filament heater power input to a 20 cm diameter x 23 cm long source can be 50 kW or higher, practically all of which is absorbed

in the cooling water. Water flow calorimetry measurements were made to determine the heat loads on the bucket walls, grid no. 1, and magnetic filter rods. The measurements are presented for two different filament locations, for three different values of arc power, and for three values of source gas pressure. 1 ref., 4 figs., 2 tabs.

09 OTHER SYNTHETIC AND NATURAL FUELS

0901 Hydrocarbon Fuels

REFER ALSO TO CITATION(S) 8394, 8416

8682 **(DOE/PC/90533—4) Deactivation by carbon of iron catalysts for indirect liquefaction: Annual technical progress report, September 15, 1986-September 14, 1987.** Bartholomew, C.H. (Brigham Young Univ., Provo, UT (USA)). 15 Nov 1987. Contract FG22-86PC90533. 36p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88002722/JAW.

Progress was made in the design and construction of a computer-automated reactor system to be used in the kinetic and deactivation studies. A new HP5890 chromatograph was ordered and received as part of this system. Kinetic data for CO hydrogenation on two samples of unsupported, unpromoted iron (reduced at 300 and 400°C respectively) were obtained as functions of temperature and time. The activity/selectivity data are consistent with those previously reported for supported, unpromoted iron. 49 refs., 18 figs., 9 tabs.

8683 **Viscosity of liquid toluene in the temperature range 25-75°C.** Goncalves, F.A.; Hamano, K.; Sengers, J.V.; Kestin, J. (Univ. of Maryland, College Park). *International Journal of Thermophysics;* **8**: No. 6, 641-647(Nov 1987). Contract FG22-85PC80505.

New accurate experimental data are presented for the viscosity of liquid toluene. The viscosity was measured relative to the viscosity of liquid water with the aid of an Ubbelohde capillary viscometer. The data cover a temperature range from approximately 25 to 75°C and are represented with high precision by an Arrhenius equation.

8684 **Formation of aromatic compounds from carbohydrates. Reaction of xylose, glucose, and glucuronic acid in acidic solution at 300°C.** Theander, O.; Nelson, D.A.; Hallen, R.T. (Dept. of Chemistry and Molecular Biology, Swedish Univ. of Agricultural Sciences, S-75007 Uppsala). *Preprints of Papers, American Chemical Society, Division of Fuel Chemistry;* **32**: No. 1, 143-147(Apr 1987). (CONF-870410—).

From 193. national meeting of the American Chemical Society; Denver, CO, USA (5 Apr 1987).

For several years respective groups have investigated the formation of aromatic compounds from carbohydrates in aqueous solution at various pH values under reflux or hydrothermolytic conditions. Previous hydrothermolytic studies of cellulose indicated that certain aromatic products could be obtained when the pH was maintained in the range of 4-11. This suggested that aldol condensation, a prime route for the production of aromatics from saccharides, could function under moderately acidic conditions. The current research was initiated to study the competition between the formation of phenolic compounds (aldol involvement) and that of furans (dehydration and cyclization).

0902 Alcohol Fuels

REFER ALSO TO CITATION(S) 9018, 9019

8685 **(CONF-8710145—2) Fusarium strain development and selection for enhancement of ethanol production.** Antonopoulos, A.A.; Wene, E.G. (Argonne National Lab., IL (USA)). 1987. Contract W-31109-ENG-38. 10p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88002970/JAW.

From Biochemical conversion program annual review meeting; Golden, CO, USA (13 Oct 1987).

Research data obtained at Argonne National Laboratory indicates that selected Fusarium strains isolated from natural habitats are potential decomposers and parameters of biomass. The amount of ethanol produced is comparable to that yielded by other potential microorganisms and, moreover, Fusarium strains can ferment zylose (pentoses) while other microbes cannot. Preliminary mutagenesis studies on Fusarium isolates indicates that potential mutants can be developed which are capable of hydrolyzing more cellulosics in a shorter time as well as fermenting monosugars to ethanol at higher rates than their parental wild strains. Therefore, new studies were initiated to further enhance the ethanol production via Fusarium genetic manipulation. In particular, the aim of this task is to develop superior Fusarium strains capable of fermenting monosaccharides (specifically xylose) to ethanol, and able to tolerate higher ethanol concentrations than selected wild strains. Experimental work on hyphal fusions of selected Fusarium strains with the purpose of exploiting heterokaryosis and parasexuality for the development of new superior strains has been initiated. Bibliographic information related to Fusarium genetics and ethanol fermentation has been studied and a summary is presented. 63 refs.

13 HYDRO ENERGY

1303 Plant Design And Operation

8686 **(CONF-8708124—Exc.) City of Spokane: Upriver Dam Hydroelectric Project, rehabilitation after failure.** (USDOE Assistant Secretary for Conservation and Renewable Energy, Washington, DC). Oct 1987. Contract FC07-80ID12118. 69p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE88002495/JAW.

From Water power '87; Portland, OR, USA (9 Aug 1987).

The Upriver Dam Hydroelectric Project, City of Spokane, Washington, consists of a 40 foot high concrete dam and gated spillway structure, two powerplants, and a power canal conveying diverted water from the dam to the two powerplants. Approximately $10 million worth of damage occurred when a lightning strike caused a fault on the transmission intertie to the project. The fault triggered a full load rejection of all generating units, causing loss of power to the spillway gates. Efforts to restart the units or provide auxiliary power to the gates were unsuccessful. As a result, the river level rose quickly and water overtopped and breached project embankments. Portions of the power canal were eroded and the foundation of one powerhouse was partially washed away. The papers in this volume describe the accident investigation, repairs to the mechanical structures, and repairs and improvements to the electrical and control systems. Three separate abstracts were prepared for the papers in this report. (JDH)

8687 (CONF-8708124—Exc., pp 1-13, Part A) **Part A: Failure investigation and lessons to be learned.** Hokenson, R.A.; Shelton, W.L.; Verigin, W.M.; Miller, G.W.; Nandagopal, M.R. (R.W. Beck and Associates, Seattle, WA; State of California, Sacramento; City of Spokane, WA). Oct 1987. NTIS, PC A04/MF A01. Order Number DE88002495/JAW.

From Water power '87; Portland, OR, USA (9 Aug 1987).

A lightning strike caused electrical failure at Spokane's two Upriver power plants, resulting in the river overtopping Project embankments, and causing nearly $11.5 million in damage to the facilities. The City moved swiftly to expedite an investigation and to repair the damage. The failure investigation uncovered the fatal flaws of the Project design and operation which had allowed the accident to occur. These included deficiencies in the following areas: reservoir freeboard, electrical systems, mechanical systems, emergency action plan, operator training and staffing, equipment maintenance, management and budgeting procedures and regulatory agencies review. 2 figs.

8688 (CONF-8708124—Exc., pp 1-12, Part B) **Part B: Rehabilitation and enhancement of project civil and mechanical facilities.** Hokenson, R.A.; Shelton, W.L.; Verigin, W.M.; Miller, G.W.; Nandagopal, M.R. (R.W. Beck and Associates, Seattle, WA; State of California, Sacramento; City of Spokane, WA). Oct 1987. NTIS, PC A04/MF A01. Order Number DE88002495/JAW.

From Water power '87; Portland, OR, USA (9 Aug 1987).

A feasibility investigation of rehabilitation alternatives for the Upriver Dam Hydroelectric Project was conducted which identified several alternatives for repairing the damage and placing both powerhouses back on-line. These alternatives are discussed and the alternative selected by the City to be implemented is highlighted. Seven separate contracts for all of the rehabilitation and enhancement work were tendered to facilitate the repairs to allow No. 2 Powerhouse to be placed back on-line by January 4, 1987, and No. 1 Powerhouse to be placed in service by April 1, 1987. Each of the contracts will be briefly discussed with respect to content, key design considerations, scheduling, federal and state review process, and construction. Of particular interest and importance is Contract No. 2 involving the replumbing of No. 1 Powerhouse by lifting the 9980-tonne (11,000-ton) structure vertically, in a series of prescribed increments to allow for leveling. A series of jacks founded on an upstream reinforced concrete slab and a downstream system of twenty-four 91-cm (36-inch) diameter cast-in-place concrete piles allowed the building to be leveled and the turbine-generator units to be plumbed. Design and construction considerations involving this unusual undertaking are discussed. 3 figs.

8689 (CONF-8708124—Exc., pp 1-9, Part C) **Part C: Rehabilitation and enhancement of project electrical features.** Hokenson, R.A.; Shelton, W.L.; Verigin, W.M.; Miller, G.W.; Nandagopal, M.R. (R.W. Beck and Associates, Seattle, WA; State of California, Sacramento; City of Spokane, WA). Oct 1987. NTIS, PC A04/MF A01. Order Number DE88002495/JAW.

From Water power '87; Portland, OR, USA (9 Aug 1987).

The Upriver Dam hydroelectric facilities originally consisted of two powerhouses, one switchyard, gated spillway, canal, and a standby gasoline engine-generator. Both powerhouses were tied to Washington Water Power through a single main power transformer. No. 1 Powerhouse and the spillway gates were operated remotely from the Well Electric Building. Prior to the failure, the Upriver Dam hydroelectric facilities were operated with insufficient electrical system control and protection. Modifications were planned to correct the deficiencies in controls and protection. In order to expedite work to meet an on-line date of January 1, 1987, for No. 2 Powerhouse and April 1, 1987, for No. 1 Powerhouse, electrical work was separated into several contracts. Corrections and wiring for No. 2 Powerhouse and No. 1 Powerhouse controls and protection were designed and supervised in the field. Assistance was also provided for plant startup. 3 figs.

1305 Economics And Management

REFER ALSO TO CITATION(S) 8768

14 SOLAR ENERGY

1405 Solar Energy Conversion

REFER ALSO TO CITATION(S) 8684, 9230, 9520, 9521, 10330

8690 (DOE/ER/13053—6) **Energetics of end product excretion in anaerobic bacteria and the metabolism of fatty acids by Syntrophomonas wolfei: Progress report, November 16, 1986-November 15, 1987.** McInerney, M.J. (Oklahoma Univ., Norman (USA)). 1987. Contract AS05-83ER13053. 6p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88002790/JAW.

We have studied the growth and metabolism of Syntrophomonas wolfei in pure culture with crotonate as the energy source. S. wolfei grows in crotonate mineral salts medium without rumen fluid with cobalamin, thymine, lipoic acid and biotin added. However, after four to six transfers in this medium, growth ceases, indicating that another vitamin is required. The chemically defined medium allows large batches of S. wolfei to be grown for enzyme purification. All the enzymes involved in the oxidation of crotonyl-CoA to acetate have been detected. The pure culture of S. wolfei or coculture of S. wolfei grown with crotonate contain high activities of a crotonate: acetyl-CoA CoA-transferase activity. This activity is not detected in cocultures grown with butyrate. Thus, we believe that the reason why S. wolfei can now grow with crotonate is that an alteration or mutation occurred which allows the organism to activate this crotonate. S. wolfei also makes small amounts of H_2 when grown in pure culture with crotonate. A methyl viologen-dependent hydrogenase activity was found. We have also demonstrated the production of H_2 from 3-hydroxybutyryl-CoA in cell-free extracts of S. wolfei by coupling H_2 production to CH_4 production with the addition of Methanobacterium bryantii and directly using a hydrogen electrode. These results clearly show that S. wolfei makes H_2. S. wolfei does not contain formate dehydrogenase or CO dehydrogenase activities.

8691 (DOE/ER/13188—4) **Nitrogen control of chloroplast development: Progress report.** Schmidt, G.W. (Georgia Univ., Athens (USA). Dept. of Botany). Nov 1987. Contract FG09-84ER13188. 7p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88003186/JAW.

A manifestation of nitrogen deficiency in vascular plants and algae is chlorosis, indicating that chloroplast biogenesis can be strongly restricted by direct or indirect effects of nitrogen assimilation products. To define the molecular basis of nitrogen responses we are using Chlamydomonas reinhardtii. Depending on the levels of ammonium, steady-state deficiency conditions are established such that the cellular levels of chlorophylls and xanthophylls are depressed. Chloroplasts in nitrogen-deficient cells contain appreciable levels of carbon assimilation enzyme and thylakoids with high electron transport activities. However, the light harvesting complexes are nearly absent and Photosystem I exhibits unusual characteristics. Studies of rates of protein synthesis by in vivo pulse-chase labeling and levels of RNAs encoded by the chloroplast and nuclear genomes have been initiated: the accumulation of transcripts for the nuclear light-harvesting apoproteins is dramatically altered qualitatively and quantitatively; there is no major effect on chloroplast RNAs but, in general, these are inefficiently utilized for protein synthesis until nitrogen is provided to the cultures. Supplying nitrogen results in an almost immediate release of chloroplast mRNAs from a translational arrest but the stimulation of the accumulation of nuclear transcripts for light-harvesting apoproteins does not occur until after a 1-2 hour lag.

8692 (DOE/ER/13476—3) **[Factors governing light driven electron and proton translocation in proteins across membranes]: Technical report, October 1987-October 1988.** (Pennsylvania Univ., Philadelphia (USA)). 1988. Contract FG02-86ER13476. 4p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE88002716/JAW.

Progress in development of photosynthetic membranes using phospholipid-reaction center dispersions is described. (DT)

8693 (EUR—10011) **Final report on the research contract for activity regarding support structures for PV generator. Final report on the study contract for the realization of building low-cost structure for the large PV generator at Castellina in Chianti.** Casirati, M.; Leonardini, L.; Paoli, P. (Istituto Sperimentale Modelli e Structure SpA, Bergamo (Italy); CRITA, Pisa (Italy); Ente Nazionale per l'Energia Elettrica, Rome (Italy)). 1986. 151p. (In Italian). NTIS (US Sales Only), PC A08. Order Number DE88900171/JAW.

This volume contains two reports dealing with a structure used to support an array of photovoltaic cells. The system is made up of wooden poles from which steel cables are stretched under tension. The Photocell panels are suspended by the cables. The first report discusses the design, site selection, and preparation, and construction of the structure. The second presents a mechanical analysis of the supports. Two analytics were prepared for the papers in this volume. (JDH)

8694 (EUR—10011, pp III-VIII, 1-62) **Final report on the research contract for activity regarding support structures for PV generator.** Leonardini, L. (CRITA, Pisa, Italy). 1986. (In Italian). NTIS (US Sales Only), PC A08. Order Number DE88900171/JAW.

In Final report on the research contract for activity regarding support structures for PV generator. Final report on the study contract for the realization of building low-cost structure for the larger PV generator at Castellina in Chianti.

The aim of the present work was to find out the feasibility of low-cost support structures for large PV panels (20 - 25 ECU/sq.m). An unit of about 200 modules was erected in the site of Castellina in Chianti and the results of such experience was reported here. As far as the site selection is concerned, well exposed position, gentle degree of slope to reduce severe soil erosion by water, sufficient depth of stoneless soil, were chosen. The mechanical composition of soil was taken into account as another important aspect of the site. Drainage of soil was also considered necessary. On this site, light, continuous reticular systems utilizing wood and steel wires (as main structural materials similar in modern vineyard structures) were erected. The project was developed within the above mentioned limits of 20-25 ECU/sq.m. costs. Real final costs were very close to the estimated costs. An economical and technical analysis of the project was set up to demonstrate the feasibility of such structures and to decide whether or not the solutions were suitable for large scale exploitation. 48 figs.

8695 (EUR—10011, pp 63-154) **Final report on the study contract for the realization of building low-cost structure for the large PV generation at Castellina in Chianti.** Casirati, M.; Leonardini, L.; Paoli, P. 1986. (In Italian). NTIS (US Sales Only), PC A08. Order Number DE88900171/JAW.

In Final report on the research contract for activity regarding support structures for PV generator. Final report on the study contract for the realization of building low-cost structure for the large PV generator at Castellina in Chianti.

The aim of this study was the definition of low-cost solutions to optimize and maintain a satisfactory cost balance in the medium-long term between the different sub-systems and components of PV power generators. In particular, the long-term objective is to keep cost of support structures below about 20% of the total system cost. The structure built for this project consists of three rows of wooden poles, each row carrying (through a hole in poles) a bea ring cable which passes through a hole at the top of the pole and takes a natural catenary between each pins of poles. The bearing cables were tensioned using turn buckle at one ton of yield. The panels were fitted lateral reinforcements and easily mounted and clamped on the main wires. Electrical connections were low-voltage-selected because of safety reasons on the plant. Measurements on the structure under static and dynamic conditions were carried out, in order to compare the stress calculations with experimental results. The results of all those measurements led to conclude that no abnormal frequency of the structure should be considered limitative for the realization of the project. This analysis was of crucial importance for the feasibility of such structures and for the decision whether to decide or not that the solution be suitable for long scale exploitation. 7 refs., 57 figs.

8696 (EUR—10099) **Research on a solar biotechnology based on the culture of photosynthetic cells.** Gudin, C.; Chaumont, D.; Desanti, O.; Pioline, D. (Laboratoire d'Heliosynthese BP, 13 - Lavera (France); Societe Francaise des Petroles BP, 92 - Courbevoie (France)). 1986. 42p. (In French). NTIS (US Sales Only), PC A03. Order Number DE88900129/JAW.

To evaluate the potential offered by different photosynthetic organisms, a study of the growth of Enteroporpha lingulata and Synechocystis sp. was conducted on a laboratory scale and several trials in batch culture. From a methodological point of view, the batch culture is the easiest way of comparing the growth physiology of two strains of cells. But this method does not permit taking account of the dynamic aspect on which the extrapolation of the trials on a large scale must be based. For this reason, the continuous culture system was chosen to compare the potential of two blue-green algae Synechocystis sp. (previously studied in batch system) and Spirulina maxima. Results and conclusions of this comparative ecophysiological study of the three strains, each of potential interest, are given. In conclusion, the research carried out in this project shows that the three strains have different behavior, but nevertheless, their specificity permits them to cover a wide range of applications according to the climatic conditions (25°C, 32°C, 42°C) and the nature of the water (polluted, brackish, salted). 17 figs., 11 tabs.

8697 (EUR—10149) **Analysis of utilizing agricultural waste through its conversion to combustible fuel: Final report.** Bandettini, R. (Florence Univ. (Italy)). 1985. 41p. (In Italian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88900127/JAW.

A study of the characteristics and the energy needs of farms, agro-industries and forestry organizations has been carried out for the Tuscany region of Italy. Data on biomass resources are given, together with some data on the potential of energy crops and harvesting costs. The socio-economic benefits, which derive from a wide regional penetration of the biomass pyrolytic conversion technology, are evaluated. 7 refs., 22 tabs.

8698 (INIS-BR—903, pp 515-520) **New technique for production of amorphous silicon solar cells.** Andrade, A.M. de; Pereyra, I.; Sanematsu, M.S.; Corgnier, S.L.L.; Fonseca, F.J. (Sao Paulo Univ., Brazil. Escola Politecnica). 1984. (In Portuguese). NTIS (US Sales Only), PC A12/MF A01. Order Number DE88700663/JAW. (CONF-8402101—).

From Simposio Latino-Am. de Fis. dos sistemas amorfos; Niteroi, Brazil (1 Feb 1984).

It is presented a new technique for the production of amorphous silicon solar cells based on the development of thin films of a-Si in a reactor in which the decomposition of the sylane, induced by capacitively coupled RF, and the film deposition occur in separate chambers. (M.W.O.).

8699 (N—87-29957) **Computer modelling of aluminum-gallium arsenide/gallium arsenide multilayer photovoltaics.** Wagner, M.B. (Illinois Univ., Urbana (USA)). 1987. 39p. (NASA-CR—181418; NAS—1.26:181418). NTIS, PC A03/MF A01.

The modeled cascade cells offer an alternative to conventional series cascade designs that require a monolithic intercell ohmic contact. Selective electrodes provide a simple means of fabricating three-terminal devices, which can be configured in complementary pairs to circumvent the attendant losses and fabrication complexities of intercell ohmic contacts. Moreover, selective electrodes allow incorporation of additional layers in the upper subcell which can improve spectral response and increase radiation tolerance. Realistic simulations of such cells operating under one-sun AMO conditions show that the seven-layer structure is optimum from the standpoint of beginning-of-life efficiency and radiation tolerance. Projected efficiencies exceed 26 percent. Under higher concentration factors, it should be possible to achieve efficiencies beyond 30 percent. However, to simulate operation at high concentration will require a model for resistive losses. Overall, these devices appear to be a promising contender for future space applications.

8700 (N—87-29958) **Modelling of multijunction cascade photovoltaics for space applications.** Educato, J.L. (Illinois Univ., Urbana (USA)). 1987. 42p. (NASA-CR—181417; NAS—1.26:181417). NTIS, PC A03/MF A01.

An alternative class of photovoltaics was presented, which is designed to overcome two problem areas with conventional cascade designs: poor upper subcell performance and lossy intercell ohmic contact (IOC). It was shown that upper subcell quality can be improved by incorporating additional junctions into the upper subcell and that the problems with monolithic IOCs may be circumvented by using complementary pairs of three-terminal cells or a 1 x 2 voltage-matched configuration. Realistic simulations show that AlGaAs-GaAs and AlGaAs-InGaAs multijunction, multibandgap solar cells (MJSC) may achieve benginning-of-life (BOL) one-sun, AMO efficiencies of 26 and 28 percent, respectively. Complementary cells made in the AlGaAs-InGaAs system can achieve BOL one-sun AMO efficiencies in excess of 27 percent. Seven-layer

MJSCs are most advantageous for space applications due to their superior tolerance to radiation degradation.

8701 (SERI/CP—211-3086(Rev.3/87), pp 51-61) **Research on high efficiency single junction monolithic thin film amorphous silicon solar cells.** Wiesmann, H.; Dolan, J.; Danginis, V.; Fricano, G. (Plasma Design Group, Stony Brook, NY; VLE Inc., E. Northport, NY). Jan 1987. NTIS, PC A13. Order Number DE87001120/JAW. (CONF-870115—).

From Amorphous silicon subcontractors' review meeting; Palo Alto, CA, USA (26 Jan 1987).

The goal of this research was to produce 8% efficient solar cells deposited at a rate of 15 angstroms/second or greater. Intrinsic material quality was evaluated using dark conductivity, photoconductivity, surface photovoltage (SPV), and space charge limited currents (SCLC). Finished solar cells were analyzed using uncorrected quantum yield and uncorrected quantum yield under 1 volt reverse bias. Efficiencies were measured under simulated global AM1.5 illumination. A peak efficiency of 7.6% was achieved where the intrinsic layer was deposited at 15 angstroms/second.

8702 (SERI/CP—211-3086(Rev.3/87), pp 63-72) **Japanese a-Si program.** Wakamatsu, S. (New Energy Development Organization, Tokyo, Japan). Jan 1987. NTIS, PC A13. Order Number DE87001120/JAW. (CONF-870115—).

From Amorphous silicon subcontractors' review meeting; Palo Alto, CA, USA (26 Jan 1987).

8703 (SERI/CP—211-3086(Rev.3/87), pp 91-100) **Amorphous silicon photovoltaic devices prepared by photochemical vapor deposition of higher order silanes.** Delahoy, A.E.; Ellis, F.B. Jr.; Doele, B.; Tonon, T. (Chronar Corp., Princeton, NJ). Jan 1987. NTIS, PC A13. Order Number DE87001120/JAW. (CONF-870115—).

From Amorphous silicon subcontractors' review meeting; Palo Alto, CA, USA (26 Jan 1987).

This research concerns the properties of a-Si:H films and solar cells prepared by mercury-sensitized photochemical vapor deposition (photo-CVD) of silane and disilane. It represents an outgrowth of earlier work on thermal CVD in which disilane was decomposed by heat alone. In the photo-CVD technique the enrgy source for decomposition is a low pressure mercury lamp. Amorphous silicon films prepared by photo-CVD are superior to thermal CVD films by virtue of having a higher photoconductivity and a lower density of defects such as dangling bonds. While the conversion efficiency of photo-CVD solar cells has not yet equalled the best glow discharge (GD) cells, it appears that photo-CVD cells are more resistant to light induced degradation.

8704 (SERI/CP—211-3086(Rev.3/87), pp 113-122) **Chemical vapor deposition of hydrogenated amorphous silicon films.** Chu, Ting L.; Chu, S.S.; Bylander, E.G.; Ang, S.T. (Southern Methodist Univ., Dallas, TX). Jan 1987. NTIS, PC A13. Order Number DE87001120/JAW. (CONF-870115—).

From Amorphous silicon subcontractors' review meeting; Palo Alto, CA, USA (26 Jan 1987).

The chemical vapor deposition (CVD) of hydrogenated amorphous silicon (a-Si:H) films using the thermal decomposition of disilane and polysilanes in an atmospheric pressure gas flow system has been under investigation as an alternative to the flow discharge technique. The advantages of the atmospheric pressure CVD, such as the ease of operation, higher deposition rates of a-Si:H films, and the absence of charged particle bombardment, have stimulated further investigations of this process. While the electronic properties of early CVD a-Si:H films are inferior to those of glow discharge films, continued optimization of the deposition process has improved significantly the electronic properties of CVD a-Si:H films. In this work, a-Si:H films have been deposited on Corning 7059 glass and other substrates by the thermal decomposition of disilane in a helium or a hydrogen flow. Under the same deposition conditions, the deposition rate of a-Si:H in He is significantly higher than that in H_2. Also, a-Si:H films deposited in He have been found to have better structural and electronic properties and lower defect densities than those deposited in H_2. Further, a post deposition treatment of a-Si:H films deposited in He has been shown to reduce the defect density to (2 to 4) x 10^{15} cm^{-3}, as measured by photothermal deflection spectroscopy. The experimental procedures and results are summarized in this paper.

8705 (SERI/CP—211-3086(Rev.3/87), pp 271-276) **ARCO Solar progress review.** Morel, D.L. (ARCO Solar, Inc., Chatsworth, CA). Jan 1987. NTIS, PC A13. Order Number DE87001120/JAW. (CONF-870115—).

From Amorphous silicon subcontractors' review meeting; Palo Alto, CA, USA (26 Jan 1987).

ARCO Solar has been pursuing the development of thin films as the next generation of photovoltaics to substantially displace the present dominant technology based upon crystalline silicon. We have chosen two thin film materials, namely, thin film Si:H or a-Si (TFS) and copper indium diselenide (CIS). These have band gaps of 1.7 and 1.0 eV, respectively, and offer opportunities as stand-alone devices with high voltage or high current per unit area, respectively, as well as combined to form high efficiency tandems. In this paper a review of the development of these devices will be presented. The discussion will begin with products that have been introduced and proceed through products presently being introduced to predictions of future product expectations and progress made toward those expectations.

8706 **Density of states near mid gap in hydrogenated amorphous silicon.** Yahya, E.; Shanks, H.R. (Surabaya Inst. of Tech., Indonesia; Ames Lab., IA, USA). *Solar Energy Materials;* **16**: No. 1-3, 189-198(Aug 1987). (CONF-8604370—). Contract W-7405-ENG-82.

From 5. conference on optical materials technology for energy efficiency and solar energy conversion; Innsbruck, Austria (15 Apr 1986).

The density of states distributions near mid gap in a series of hydrogenated amorphous silicon films have been determined from space charge limited current measurements. The measurements were made on Au/a-Si:H Schottky diode structures prepared by reactive RF sputter deposition. Samples with hydrogen concentrations near 16% as determined from infrared absorption had densities of states of 3 x 10/sup 14/ states/cm/sup 3/ eV. The experimental results indicate that high quality a-Si:H films with low densities of states can be obtained under certain deposition conditions and that the density of states at mid gap is hydrogen concentration dependent with a minimum near 16%. For a given hydrogen concentration, films thicker than 2 μm yielded the lowest density of states consistent with a model in which diffusion currents can be neglected and where surface and interface layers have a higher defect density than the bulk of the film.

8707 **Spectroscopic and electrochemical studies of electrochromic hydrated nickel oxide films.** Yu, P.C.; Lampert, C.M.; Nazri, G. (Lawrence Berkeley Lab., CA, USA; General Motors Research Labs., Warren, MI, USA. Electrochemistry Dept.). *Solar Energy Materials;* **16**: No. 1-3, 1-17(Aug 1987). (CONF-8604370—). Contract AC03-76SF00098.

From 5. conference on optical materials technology for energy efficiency and solar energy conversion; Innsbruck, Austria (15 Apr 1986).

The electrochromic properties of hydrated nickel oxide thin films electrochemically deposited by anodization onto doped tin-oxide-coated glass have been studied by transmittance measurements, cyclic voltammetry, Fourier-transform infrared spectroscopy, and ion-backscattering spectrometry. The spectral transmittance is reported for films switched in both the bleached and colored states. The photopic transmittance T/sub p/ can be switched from T/sub p/ (bleached) = 0.77 to T/sub p/ (colored) = 0.21, and the solar transmittance T/sub s/ can be switched from T/sub s/ (bleached) = 0.73 to T/sub s/ (colored) = 0.35. Also reported is the near-infrared transmittance T/sub NIR/, which found to switch from T/sub NIR/ (bleached) = 0.72 to T/sub NIR/ (colored) = 0.55 with a film thickness of 50 nm. The bleached condition is noted to have very low solar absorption in both the visible and solar regions. Ion-backscattering spectrometry was performed on the hydrated nickel oxide film, yielding a composition of NiO/sub 1.0/ (dehydrated). Cyclic voltammetry showed that, for films in the bleached or colored state, the reversible reaction is Ni(OH)/sub 2/

reversible NiOOH+H/sup +/e/sup -/. Voltammetry also showed that the switching of the film is controlled by the diffusion of protons, where OH/sup -/ plays a role in the reaction mechanism. Analysis of the hydrated nickel-oxide thin films by Fourier-transform infrared spectroscopy revealed that both the bleached and colored states contain lattice water and hydroxyl groups. The surface hydroxyl groups play an important role in the coloration and bleaching of the anodically deposited nickel oxide thin films.

8708 **Some aspects of pyrolysis oils characterization by high performance size exclusion chromatography (HPSEC).** Johnson, D.K.; Chum, H.L. (Chemical Conversion Research Branch, Solar Energy Research Institute, 1617 Cole Blvd., Golden, CO 80401). *Preprints of Papers, American Chemical Society, Division of Fuel Chemistry;* 32: No. 1, 167-177(Apr 1987). (CONF-870410—).

From 193. national meeting of the American Chemical Society; Denver, CO, USA (5 Apr 1987).

The utilization of biomass pyrolysis oils or isolated fractions of these feedstocks requires a fast overall characterization technique. Gas chromatographic techniques typically analyze only the volatile fraction (5%-50%) of underivatized oils. With proper choice of solvent and detector systems, the HPSEC on polystyrene-dividylbenzene copolymer gels of the whole oils can provide valuable information on the apparent molecular weight distributions and changes that occur upon aging or chemical fractionation. Several pyrolysis oils have been analyzed as well as fractions isolated by solvent elution chromatography. In order to understand better the observed low-molecular-weight region, a number of model substances of the main classes of compounds found in pyrolysis oils have been investigated. While hydrogen bonding between the phenolic groups and tetrahydrofuran occurs, solute-solute interactions can be kept very small by operating at very low concentrations of solute; solute-gel interactions do occur when polycyclic aromatic compounds predominate. HPSEC provides very good information on shelf life, reactivity of pyrolysis oils, and comparison of oils as a function of process conditions.

1406 Photovoltaic Power Systems

8709 **(BMFT-FB-T—86-199) Energy autarchic solar system (ENASS). Final report.** Engemann, D.; Rickus, E. (Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.); Stiebel Eltron G.m.b.H. und Co. KG, Holzminden (Germany, F.R.); Battelle-Institut e.V., Frankfurt am Main (Germany, F.R.)). Dec 1986. 137p. (In German). NTIS (US Sales Only), PC A07/MF A01. Order Number DE88750519/JAW.

A technical study on a hybrid solar system, combining solar cells with flat plate collectors, was realized. According to the study, a hybrid solar system will supply up to 60% of single family house energy demand in moderate climate areas. The subject of the research project 'Energy autarchic solar system' was the verification of the proposed solar system. In the course of operation many important hints for system optimization were obtained. The energy savings, expected by the study, were not attained. The main reason was the insufficient adjustment of essential components. However experience learned, improvements would gain the energy savings up to 70%. With 1 ref., 2 tabs., 94 figs..

1407 Solar Thermal Power Systems

REFER ALSO TO CITATION(S) 10026

8710 (ESA-SP—267, pp vp) **Solar dynamic power system concept: terrestrial experiences and their extension to space applications.** Lucifredi, A.; Ravina, E.; Repetto, F. (Ansaldo S.p.A., Genoa, Italy). Nov 1986. NTIS, PC A21/MF A01. (ETN—87-90157; CONF-8609216—).

From 5. conference on photovoltaic generators in space; Noordwijk, Netherlands (30 Sep 1986).

The characteristics of solar thermal concentration power systems for terrestrial applications are described. Designs and experiences on steam and gas solar plants and components are reported. Comparison of alternatives for use in solar dynamic power systems (photovoltaic, solar dynamic, nuclear) shows an intermediate range of power where a potential exists for the use of solar dynamic systems adopting parabolic dish concentrators and cavity receivers. Problems for the development of dynamic conversion system arising from environmental conditions and from requirements on reliability, maintainbility, and lifetime, which affect the components and system characteristics are reviewed. A possible use of the thermo-solar orbiting converter, besides the electric power generation, could be to satisfy thermal loads (melting, chemical reactions, heating).

8711 **Flux-off convective loss tests on the MSEE external solar central receiver.** Boehm, R.; Nakhaie; Bergan, N. New York, NY; American Society of Mechanical Engineers (1987). 7p. (CONF-861211—). American Society of Mechanical Engineers, 345 East 47 St., New York, NY 10017.

From American Society of Mechanical Engineers winter meeting; Anaheim, CA, USA (7 Dec 1986).

Technical Paper 86-WA/SOL-2.

Convective heat transfer coefficients have been measured from "flux-off" thermal loss tests on the Molten Salt Electric Experiment (MSEE) external solar central receiver. These measured convective heat transfer coefficients are used to validate empirical correlations for convective losses. The empirical correlations are derived by modifying Siebers and Kraabel's correlations to account for wind direction and surface roughness. By varying the wind direction and surface modification factors, the author compared measured data to empirical correlations. Despite high experimental uncertainties, they find predictive correlations which mirror the general trends in the experimental data. However, in almost all cases, the predicted heat transfer coefficients are higher than the values inferred from measurements. To demonstrate the relevance of convective losses, the MSEE receiver thermal efficiency is calculated as a function of wind speed, using three different modification factors in the empirical correlation for forced convection. These three factors bound the calculated efficiency drop to between 2 to 8% for wind speeds from zero to thirty miles per hour (thirteen meters per second). Measured data indicates the effect of wind on the thermal efficiency is between 3 and 5%.

8712 **Convective loss measurements at the 10 MW/sub ϵ/ solar thermal central receiver pilot plant.** Stoddard, M.C. New York, NY; American Society of Mechanical Engineers (1987). 7p. (CONF-861211—). American Society of Mechanical Engineers, 345 East 47 St., New York, NY 10017.

From American Society of Mechanical Engineers winter meeting; Anaheim, CA, USA (7 Dec 1986).

Technical Paper 86-WA/SOL-3.

Experiments were performed at the 10 MW/sub ϵ/ Solar Thermal Central Receiver Pilot Plant to measure the convective heat transfer from the receiver. Determining the convective loss will help reduce the uncertainty in the calculation of thermal efficiency for solar central receivers. Two types of results are presented from the data: (i) the overall receiver convective coefficient, and (ii) detailed information on the local (panel) losses as a function of wind direction. The overall measured convective coefficient is also compared with predictions from correlations developed to calculate the convective coefficient. The comparison between the measured and predicted convective coefficients is good, although the correlations tend to overpredict the measured data by about 10%.

8713 **Evaluation of three gas turbine systems for high temperature solar applications.** Spasyk, M.; Boehm, R. New York, NY; American Society of Mechanical Engineers (1987). 8p. (CONF-861211—). American Society of Mechanical Engineers, 345 East 47 St., New York, NY 10017.

From American Society of Mechanical Engineers winter meeting; Anaheim, CA, USA (7 Dec 1986).

Technical Paper 86-WA/SOL-7.

This study focuses on the analysis of three types of Brayton cycles. The impetus for this study is the need to define possible higher temperature successors for Rankine-based engines in solar central receiver power generating systems. Steam-injected gas turbine engines (denoted in what follows as "STIG") and the more conventional regenerated-intercooled-reheat forms (denoted as "IGT") are compared to simple Brayton cycles (denoted as "GT")

by computer modeling over a wide range of pertinent parameters. Attempts are made to represent the systems with realistic component performances. Results show that efficiencies were highest for the IGT followed by the STIG and GT, respectively. Considerable improvements in specific work output were demonstrated by the STIG over both the IGT and GT systems. First Law analysis of the effect of turbine inlet temperature shows a gradual increase of efficiency with turbine inlet temperature, with diminishing returns at higher temperatures. Although there are significant practical problems associated with higher temperature applications, both in terms of engine and receiver considerations, they do not seem to be insurmountable. These results demonstrate reason for optimism about increased performance for higher temperature air-based systems compared to Rankine systems at presently used temperatures.

1409 Solar Thermal Utilization

REFER ALSO TO CITATION(S) 8709, 8715, 8980, 8981

8714 **Solar solids reactor.** Yudow, B.D. (to Dept. of Energy, Washington, DC). US Patent 4,706,651. 17 Nov 1987. Filed date 24 Feb 1986. vp. Patent and Trademark Office, Box 9, Washington, DC 20232.

A solar powered solids reactor is described comprising: walls forming a chamber having rearward and forward end portions, side portions, and a top and bottom; means supporting the walls in a substantially fixed position so the chamber cannot continually rotate; means for feeding solid material which is to be thermally reacted into the rearward end portion of the chamber; means coupled to the forward end portion of the chamber for receiving solid material after it has been at least partially reacted in the chamber. The chamber walls have an aperture which passes solar radiation into the forward end portion of the chamber means for directing concentrated solar radiation through the aperture onto at least the top of the chamber; means located in the top of the chamber for receiving the solar radiation and for directing heat created by the solar radiation towards the bottom of the chamber; and linear conveyor means located adjacent the bottom of the chamber for moving material received at the rearward end portion of the chamber, in a layer, along the bottom of the chamber to the forward end portion, while maintaining a top of the layer exposed to receive the heat created by the solar radiation.

1410 Solar Collectors And Concentrators

REFER ALSO TO CITATION(S) 8712, 9102

8715 **(BMFT-FB-T—86-195) Testing of simple solar air collectors 'Air collector test II'. Final report.** Reuss, M.; Schmalschlaeger, T.; Schulz, H. (Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.); Bayerische Landesanstalt fuer Landtechnik, Freising (Germany, F.R.)). Dec 1986. 117p. (In German). NTIS (US Sales Only), PC A06/MF A01. Order Number DE88750513/JAW.

Development and improvement of simple solar air heaters for agricultural and industrial applications. Different types of roof integrated collectors were developed and installed and tested at our test facility. Descriptions and drawings of these collectors are given in this report. Performance measurements under steady- and quasi-steady-state conditions. The outdoor test installation was enlarged by a test place for steady state conditions and for hybrid-water/air collectors. At the installed collectors measurements under different meteorological conditions were performed over several months. Material-testing was performed on the used collector glazing materials. The mechanical stability and the spectral transmission was measured. Big plants were planned and measured in practice for drying of hay and other agricultural products. With 30 refs., 35 tabs., 85 figs..

8716 **(BMFT-FB-T—86-213) Technical applications of solar energy. Project 'Selective coatings'. Final report.** Gindele, K.; Honstetter, K.; Koehl, M.; Lehner, G.; Mast, M. (Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.); Stuttgart Univ. (Germany, F.R.). Inst. fuer Theorie der Elektrotechnik). Dec 1986. 61p. (In German). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88750515/JAW.

The following report deals with the investigation of selective solar absorber coatings. The following topics are treated in detail: Measurement of the optical properties: methods for the determination of the spectral directional emittance, particularly with the use of an integrating sphere in the infrared, are represented and compared. - Investigations of material distribution and surface structure: a procedure for the extraction of characteristic quantities describing the surface structure, as correlation length and mean distance between the structure elements, from scanning electron microscope images is explained. - Production of selective coatings: the production of cermet layers with PVD especially with a graded volume fraction of the metal is described. For Ni/MgF/sub 2/ layes absorptance values from 0.95 to 0.97 at emittances from 0.05 to 0.10 were reached. In addition several models for the theoretical description are discussed. The influence of the production parameters on the optical properties of nickel oxide coatings deposited in an AC electroplating process is represented. - Ageing stability: a method for the estimation of the life time with accelerated tests at constant temperatures is investigated exemplarily for copper oxide coatings. With 43 refs., 1 tab., 44 figs..

8717 **(EUR—10381) Study resulting in the construction and development of an insulating translucent panel made of Pyrex tubes under vacuum.** Courtier, A.; Liebard, A.; Alexandrof. (Corning France, 77 - Avon; Corning France, 75 - Paris). 1986. 90p. (In French). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88900240/JAW.

The net gain between absorption during the day and losses during the night of a glass panel is a function of the transmission of the light and the coefficient, K, of heat loss. In order to reduce this coefficient, several products are now sold on the market: double glazing, K = 3,2 W/M2°C; triple glazing, K = 2,4 W/M2°C; and ref single glass, K = 5 W/M2°C. The purpose of this project is to develop a translucent panel which can both transmit solar radiation and be a permanent insulation, using tubes of Pyrex in which a relative vacuum has been created. The objective is to confirm that such a panel will have K value between 0,6 and 1,3 W/M2°C. 11 figs.

15 GEOTHERMAL ENERGY

1501 Resource Status And Assessment

8718 (EPRI-AP—4259-SR-Vol.2, pp 2.1-2.10) **Current perspectives on the development of geothermics in Mexico.** Espinosa, H.A. (Comision Federal de Electricidad, Michoacan, Mexico). Aug 1987. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88920017/JAW. (CONF-8506369—Vol.2).

From 9. annual geothermal and second IIE-EPRI geothermal conference and workshop; San Diego, CA, USA (25 Jun 1985).

Taking March 1985 as the limit, here are some comments on the present situation of geothermics in Mexico, in relation to the other sources of energy. A brief history is given of exploration and the principal activities currently under way in this area. The present geothermal potential of the country is shown, divided into proven, probable, and possible reserves. The amount of geothermal machinery currently installed and its nominal power are given. The geothermal expansion program is presented, for the next 15 years, indicated what is to be invested in power plants and portable back pressure units. The plans for the almost complete manufacture of the latter within the country are explained, as well as the advantage of this from the point of view of economics and field exploration. Finally, some studies are mentioned that are being done on the behavior of geothermal fluids and the full use of the components of the brine. 6 figures, 1 table.

8719 (EPRI-AP—4259-SR-Vol.2, pp 4.1-4.9) **Geothermal program of the Instituto de Investigaciones Electricas.** Mulas, P.; Nieva, D.; Hernandez, J.L. (Instituto de Invrstigaciones Electricas, Morelos, Mexico). Aug 1987. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88920017/JAW. (CONF-8506369—Vol.2).

From 9. annual geothermal and second IIE-EPRI geothermal conference and workshop; San Diego, CA, USA (25 Jun 1985).

A brief description is offered of the research and development activities in the area of geothermal energy being performed by the Instituto de Investigaciones Electricas [Electrical Research Institute]. The range of study and research covers all areas of activity related to geothermal fields, from exploration and development of the field to installation and operation of the power plants. Almost all the work is done for the Comision Federal de Electricidad [Federal Electricity Commission] through its Gerencia de Proyectos Geotermicos [Geothermal Project Administration]. 15 references.

8720 (EPRI-AP—4259-SR-Vol.2, pp 17.1-17.21) **Recent activities in reservoir engineering at Mexico's geothermal fields.** Cesena, R.M. (Comision Federal de Electricidad, Michoacan, Mexico). Aug 1987. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88920017/JAW. (CONF-8506369—Vol.2).

From 9. annual geothermal and second IIE-EPRI geothermal conference and workshop; San Diego, CA, USA (25 Jun 1985).

The status of development of four geothermal fields in Mexico is described. At present the Cerro Prieto field generates 180 MW, and 220 MW is expected to be added shortly. With the reservoir engineering studies that are being done at this field and which are considering the application of different mathematical methods and analytic models, it is expected that in the medium and long term it will be possible to generate 620 MW with proven reserves, and further studies should define probable reserves for a total of 1540 MW. At Los Azufres in the state of Michoacan there has been a first attempt at simulation, applying SHAFT-79, developed at Berkeley. This led to the conclusion that in the southern part of the field there is sufficient mass and energy to generate an additional 55 MW to the 25 MW that have been produced since 1982 with 5 portable wellhead units. At the Los Humeros field, which is in the south central part of the state of Puebla, work is currently being done with a network of 140 units using the SHAFT simulator, and although there is not yet much information, it has been possible to determine that the reservoir is enclosed by volcanic rock of andesitic composition, which is covered by ignimbritic rock and its basement consists of sedimentary rock represented by clayey limestone. Fifteen kilometers to the west of the city of Guadalajara in the state of Jalisco there is the geothermal field of La Primavera, in which 5 exploratory wells have been drilled to depths from 700 to 2000 m; modest production has been obtained from these wells. In 1984 well PR-1 was deepened from 1226 m to 1806 m, yielding successful results (60 T/H of steam). This led to the conclusion that the reservoir is deeper and that future wells should be no less than 2000 m deep. 11 figures, 6 tables.

8721 (EPRI-AP—4259-SR-Vol.2, pp 20.1-20.5) **Geothermal assessment in the Bonneville Power Administration service area.** Seely, D.B. (Bonneville Power Administration, Portland, OR). Aug 1987. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88920017/JAW. (CONF-8506369—Vol.2).

From 9. annual geothermal and second IIE-EPRI geothermal conference and workshop; San Diego, CA, USA (25 Jun 1985).

Bonneville Power Administration (BPA) has developed geothermal resource and engineering data bases to provide information and guidance in making generation planning decisions. Preliminary analysis indicates that different reservoir confirmation strategies may be appropriate depending on the geologic province being addressed. Future planning activities will address implementation mechanisms for confirming the region's geothermal resources.

8722 (EPRI-AP—4259-SR-Vol.2, pp 21.1-21.10) **Multidisciplinary studies on the Los Azufres geothermal field, Mexico.** Nieva, D.; Iglesias, E.; Arellano, V.; Contreras, E.; Gonzalez, A.; Reyes, E. (Instituto de Investigaciones Electricas, Cuernavaca, Mexico). Aug 1987. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88920017/JAW. (CONF-8506369—Vol.2).

From 9. annual geothermal and second IIE-EPRI geothermal conference and workshop; San Diego, CA, USA (25 Jun 1985).

During the past 4 years the Electrical Research Institute did a series of multidisciplinary studies for the Federal Electricity Commission to characterize and to evaluate the high enthalpy geothermal resource at Los Azufres in the state of Michoacan, Mexico. The multidisciplinary approach has the advantage of producing a more complete and precise picture of the reservoir, relatively free of speculative conclusions based on insufficient data. The studies included the geochemistry of fluids (components of brine and of steam, and stable isotopes of hydrogen and oxygen), geochemistry of rocks, mineralogy, petrography, petrophysics, and reservoir engineering (profiles of pressure and temperature, production tests, pressure tests, etc.). The principal results of these studies include the characterization of the fluids of the reservoir, the demonstration of the variability of the composition of the gases produced, a three dimensional mineralogical-petrographic model that defines the general geometry of the reservoir, the only existing database on the physical properties of the rocks of the reservoir, estimates of the permeability of fracture and matrix of the reservoir, and of the relationship between the storage capacity of the fracture system and of the matrix rock, and a detailed model of the natural state of the fluids of the reservoir. The results show that the Los Azufres reservoir is young and very thick (possibly 2000 m), with an area of about 30 km^2, and that it is fed by a deep and extensive water table of high enthalpy (1317 +/- 103 kJ/ks). The great thickness of the reservoir and its special location at high altitude in the mountains of Los Azufres are responsible for a series of special phenomena that the multidisciplinary approach helped to reveal with great reliability. 13 references, 4 figures.

8723 (EPRI-AP—4259-SR-Vol.2, pp 37.1-37.9) **Use of computerized systems for the decision making process in geothermal energy.** Guillermo, R.O.; Ignacio, S.D. (Instituto de Investigaciones Electricas, Mexico). Aug 1987. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88920017/JAW. (CONF-8506369—Vol.2).

From 9. annual geothermal and second IIE-EPRI geothermal conference and workshop; San Diego, CA, USA (25 Jun 1985).

This article presents the current activities and results obtained by the IIE in the area of computer systems support to the prospecting, development and exploitation of the geothermal resources in Mexico. The development of computerized support for the geothermal energy efforts can be divided into three groups that are strongly interactive: (a) Geothermic Information System (SIGEO); (b) calculation and graphics procedures in two and three dimensions; and (c) instrumentation of an intelligent system for the diagnosis and forecast of electric substation faults. The SIGEO program has been installed in the Comision Federal de Electricidad (Federal Commission of Electricity). It was developed during the years of 1982 and 1983 and placed in operation in 1984. Presently, the calculations and graphics procedures work is progressing, and there is already a prototype of the Expert System. 5 references, 3 figures.

8724 (EPRI-AP—4259-SR-Vol.2, pp 41.1) **Need for a geothermal database.** Salazar, A.G. Aug 1987. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88920017/JAW. (CONF-8506369—Vol.2).

From 9. annual geothermal and second IIE-EPRI geothermal conference and workshop; San Diego, CA, USA (25 Jun 1985).

There is a deficiency in available geothermal information for the initial development of the geothermal projects. This has serious repercussions in terms of failures and excessive costs in the initial studies or in the development of the geothermal fields. The countries that have geothermal experience are very few worldwide. Also, very valuable experiences on some fields are not shared because of restrictions of the companies executing projects. In a very valuable way, OLADE has for several years been publishing its

documents on prefeasibility and feasibility for geothermal projects, which in Latin America has remedied the deficiency and large gap. Nevertheless, there is still much to do. It is necessary to compose or form a geothermal database that will allow the non-expert or layman in geothermy to obtain basic information, so as to avoid the expenditure of economic resources that are ever more scarce, and to optimize the results of the exploration and the working of the geothermal resource.

8725 **(LA-UR—87-3609) Geothermal resource assessment in Honduras: How we got to Platanares.** Laughlin, A.W.; Frank, J.A.; Flores, W. (Los Alamos National Lab., NM (USA); Empresa Nacional de Energia Electrica, Tegucigalpa (Honduras)). 1988. Contract W-7405-ENG-36. 6p. (CONF-880134—1). NTIS, PC A02. Order Number DE88001799/JAW.

From ASME/ETCE conference; New Orleans, LA, USA (11 Jan 1988).

The initial phase of a geothermal resource assessment of Honduras is essentially complete. Reconnaissance scale geological and geochemical investigations were performed at six previously identified sites to determine relative potentials for electricity generation or direct heat use. Two of the six sites were eliminated because of low potential for the production of electricity and detailed geological and geochemical work was concentrated at the remaining four sites. After an evaluation of new data, two sites (Platanares and San Ignacio) were selected for detailed geophysical surveys and one (Platanares) for gradient drilling. Very encouraging results were obtained from the drilling and it is apparent that a feasibility phase investigation is warranted at Platanares.

1502 Geology And Hydrology Of Geothermal Systems

REFER ALSO TO CITATION(S) 9977

8726 (EPRI-AP—4259-SR-Vol.2, pp 19.1-19.18) **Development of the Los Azufres geothermal field.** Suarez, R.R. (Comision Federal de Electricidad, Michoacan, Mexico). Aug 1987. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88920017/JAW. (CONF-8506369—Vol.2).

From 9. annual geothermal and second IIE-EPRI geothermal conference and workshop; San Diego, CA, USA (25 Jun 1985).

In the northeastern part of the State of Michoacan there is the Los Azufres Geothermal Zone, where the first geological, geophysical, and geochemical studies were carried out in 1975, for the basic purpose of evaluating the feasibility of using the endogenous steam for commercial purposes by generating electrical power. As a result of these studies, the first 5 exploratory wells were drilled which were the model for the construction of the following ones. At present more than 74,000 m have been drilled among 47 wells. With the double objective of observing the performance of the field under continuous working and of starting amortization of the investments for the studies, 5 turbogenerators were installed at wellheads, generating 25 MW/h with atmospheric discharge. These went into operation in September 1982, and as of March 1985 they showed an accumulated generation of 363,553 MW/h. It was decided to begin construction this year of a 50 MW geothermoelectric power plant, and for the medium and long term others of 271 MW/h are being considered. This paper describes the surface and structural geology, geochemistry, geophysics, and geology of the subsoil of this field, well drilling, injection, and production. 9 figures, 3 tables.

8727 (EPRI-AP—4259-SR-Vol.2, pp 23.1-23.10) **Overview of actual knowledge on the heat source in Los Humeros.** Verma, S.P. (Instituto de Investigaciones Electricas, Mexico). Aug 1987. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88920017/JAW. (CONF-8506369—Vol.2).

From 9. annual geothermal and second IIE-EPRI geothermal conference and workshop; San Diego, CA, USA (25 Jun 1985).

This article presents a synthesis of the methodology used to prepare a model of the heat source in a geothermal field located in siliceous type volcanic terrain as in the case of Los Humeros in Mexico. An estimate of the volume of the magmatic chamber (1500 km^3) was obtained for this field. The degree of reliability of this estimate is briefly discussed. 16 references, 5 figures.

8728 **(LBL—23950) Numerical modeling of geothermal systems with applications to Krafla, Iceland and Olkaria, Kenya.** Bodvarsson, G.S. (Lawrence Berkeley Lab., CA (USA)). Aug 1987. Contract AC03-76SF00098. 21p. (CONF-8707127—2). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88003195/JAW.

From NATO advanced study institute of geothermal reservoir engineering; Antalya, Turkey (1 Jul 1987).

The use of numerical models for the evaluation of the generating potential of high temperature geothermal fields has increased rapidly in recent years. In the present paper a unified numerical approach to the modeling of geothermal systems is discussed and the results of recent modeling of the Krafla geothermal field in Iceland and the Olkaria, Kenya, are described. Emphasis is placed on describing the methodology using examples from the two geothermal fields.

1503 Geothermal Exploration And Exploration Technology

REFER ALSO TO CITATION(S) 8444, 8719, 8722, 9975

8729 (EPRI-AP—4259-SR-Vol.2, pp 15.1-15.14) **Geothermal exploration in Mexico.** Montiel, A.R. (Gerencia de Proyectos Geothermoelectricos de CFE, Michoacan, Mexico). Aug 1987. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88920017/JAW. (CONF-8506369—Vol.2).

From 9. annual geothermal and second IIE-EPRI geothermal conference and workshop; San Diego, CA, USA (25 Jun 1985).

Mexico's geothermal development since the 1950's has seen various exploratory activities that currently cover the stages of surveying, prefeasibility, and feasibility. Surveying has been used to take stock of the geothermal zones in the entire country, with preliminary evaluation of their geothermal possibilities. Through prefeasibility studies selection is made of the geothermal zones that ought to be explored with deep wells. Finally, within the feasibility studies further exploring is done to broaden their knowledge of some fields. The present paper sums up these exploratory activities, indicating the long-term surface exploration project in the investigation of the country's geothermal possibilities. 8 figures.

8730 (EPRI-AP—4259-SR-Vol.2, pp 16.1-16.3) **Exploratory drilling at Coso geothermal field, California.** Klein, C.W.; Sanyal, S.K.; Gardner, M.C.; Briffet, R. (GeothermEx, Inc., Richmond, CA). Aug 1987. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88920017/JAW. (CONF-8506369—Vol.2).

From 9. annual geothermal and second IIE-EPRI geothermal conference and workshop; San Diego, CA, USA (25 Jun 1985).

During 1985 the Los Angeles Department of Water and Power (LADWP), with GeothermEx, Inc. as operator, conducted exploratory deep drilling on several thousand acres of Federal Government lands at the Coso Geothermal field (Coso) in east-central California. The leasehold is in the Coso Hot Springs Known Geothermal Resource Area on land included in the China Lake Naval Weapons Center, and the exploration is subject to regulation by both the US Navy and Bureau of Land Management (BLM). The geothermal field is coincident with an area of recent volcanic activity which includes extrusive volcanic domes, hot ground, fumaroles, and Coso Hot Springs, which lie at the eastern end of the volcanic area. This paper describes the prior exploration of the area, LADWP exploration and drilling program, and long-term test plans. 1 reference, 1 figure, 1 table.

8731 (EPRI-AP—4259-SR-Vol.2, pp 36.1-36.4) **Results from the geothermal chemistry subprogram: trace elements in geothermal systems.** McLearn, M.E. (Electric Power Research Institute, Palo Alto, CA). Aug 1987. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88920017/JAW. (CONF-8506369—Vol.2).

From 9. annual geothermal and second IIE-EPRI geothermal conference and workshop; San Diego, CA, USA (25 Jun 1985).

The presence of environmentally sensitive trace elements in geothermal power systems has been of increasing interest to utilities, resource operators, and resource owners because of the large costs associated with abatement and disposal. In 1984, the EPRI Geothermal Chemistry Subprogram entered a new project area comprising the investigation of the behavior of trace species in geothermal systems. Determination of forms and distribution; evaluation and design of abatement systems; and preparation of overall strategies for cost-effective control and disposal are the goals of this new project area. Because of its presence in most geothermal fluids, with associated operations and maintenance, industrial hygiene, and waste disposal concerns, arsenic was selected as the first trace element to be examined. Results from this initial study are discussed. 3 tables.

8732 **(LA-UR—87-3071) Prediction of thermal front breakthrough due to fluid reinjection in geothermal reservoirs.** Birdsell, S.A.; Robinson, B.A. (Los Alamos National Lab., NM (USA); Mechanical Design Services, Los Alamos, NM (USA)). 1987. Contract W-7405-ENG-36. 7p. (CONF-880103—1). NTIS, PC A02. Order Number DE88000524/JAW.

From Symposium on geothermal energy; New Orleans, LA, USA (10 Jan 1988).

Chemically reactive tracers can be used to measure reservoir temperature distributions because of their extreme sensitivity to temperature. If a reactive tracer flows through a reservoir from an injection well to a production well, then early in the production history the tracer will contact mostly high temperatures and experience a high percentage of decomposition. As more energy is extracted from the reservoir, subsequent reactive tracer tests will show less decomposition. Tracers must be chosen which have reaction kinetics appropriate to the temperature patterns expected in the reservoir under consideration. If kinetics are too slow, no significant reaction occurs. If kinetics are too fast, essentially all of the tracer will react. In neither case can useful information be obtained. Seventeen chemically reactive tracers have been identified which are appropriate for geothermal reservoirs in the 70 to 275°C range. Of the 17 tracer reactions investigated, 5 are hydrolysis of esters, 3 are hydrolysis of amines, and 9 are hydrolysis of aryl halides. A method for choice of the appropriate reactive tracer for a given reservoir is also presented. The method requires measurement of the residence time distribution (from a conservative tracer test), an estimate of reservoir temperature, and some simple geochemistry measurements and calculations. Several examples of choosing reactive tracers for existing geothermal reservoirs are given.

8733 **(LA-UR—87-3603) Exploration geothermal gradient drilling, Platanares, Honduras, Central America.** Goff, S.J.; Laughlin, A.W.; Ruefenacht, H.D.; Goff, F.E.; Heiken, G.; Ramos, N. (Los Alamos National Lab., NM (USA); Swissboring Ltd., Guatemala City (Guatemala); Empresa Nacional de Energia Electrica, Tegucigalpa (Honduras)). 1988. Contract W-7405-ENG-36. 11p. (CONF-880134—2). NTIS, PC A03. Order Number DE88001798/JAW.

From ASME/ETCE conference; New Orleans, LA, USA (11 Jan 1988).

This paper is a review and summary of the core drilling operations component of the Honduras Geothermal Resource Development Project at the Platanares geothermal prospect in Honduras, Central America. Three intermediate depth (428 to 679 m) coreholes are the first continuously cored geothermal exploration boreholes in Honduras. These coring operations are part of the Central America Energy Resource Project (CAERP) effort funded by the Agency for International Development (AID) and implemented by the Los Alamos National Laboratory (Los Alamos) in cooperation with the Empresa Nacional de Energia Electrica (ENEE) and the United States Geological Survey (USGS). This report emphasizes coring operations with reference to the stratigraphy, thermal gradient, and flow test data of the boreholes. The primary objectives of this coring effort were (1) to obtain quantitative information on the temperature distribution as a function of depth, (2) to recover fluids associated with the geothermal reservoir, (3) to recover 75% or better core from the subsurface rock units, and (4) to drill into the subsurface rock as deeply as possible in order to get information on potential reservoir rocks, fracture density, permeabilities, and alteration histories of the rock units beneath the site. The three exploration coreholes drilled to depths of 650, 428 and 679 m, respectively, encountered several hot water entries. Coring operations and associated testing began in mid-October 1986 and were completed at the end of June 1987.

1505 Economic And Financial Aspects

8734 (EPRI-AP—4259-SR-Vol.2, pp 25.1-25.14) **Economics of wellhead versus central power plants.** Le Bert, G.H. (Comision Federal de Electricidad, Mexico). Aug 1987. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88920017/JAW. (CONF-8506369—Vol.2).

From 9. annual geothermal and second IIE-EPRI geothermal conference and workshop; San Diego, CA, USA (25 Jun 1985).

This article presents a comparative economic analysis between a single 110 MW(e) plant using concentrated steam from various wells, condensers and extractors for non-condensable gases to maximize its efficiency, and a system of 22 units, each with a capacity of 5 MW(e), with the steam discharged at atmospheric pressure. The costs used for this comparison have been obtained from experience with the Cerro Prieto and Los Azufres operations. It is concluded that the second alternative is very attractive and should be analyzed in detail for each project where both the production of steam and the generation of electricity are contemplated. 8 references.

1506 Environmental Aspects And Waste Disposal

REFER ALSO TO CITATION(S) 8731

8735 (EPRI-AP—4259-SR-Vol.2, pp 1.1-1.6) **The Geysers: meeting the environmental and operating challenges of geothermal power.** Shackelford, B.W. (Pacific Gas & Electric Co., San Francisco, CA). Aug 1987. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88920017/JAW. (CONF-8506369—Vol.2).

From 9. annual geothermal and second IIE-EPRI geothermal conference and workshop; San Diego, CA, USA (25 Jun 1985).

The first geothermal power plant, with a capacity of 11 megawatts, began operating at The Geysers in September, 1960. The current capacity of the 17 units is 1137 megawatts. This paper discusses briefly some of the operating problems, mainly environmental, encountered throughout its 25-year history. Reinjection of the boron-containing condensate into the field as an envoironmental measure proved helpful in regenerating the thermal reservoirs to some extent. Noise pollution from the venting of steam was eliminated with the use of mufflers. Hydrogen sulfide emissions are controlled by use of the Stretford process. Change rooms, showers, and laundry facilities have been added to ensure occupational safety of maintenance personnel from such impurities as mercury and arsenic. A geothermal hazardous waste project has recently begun to investigate reduction and improved handling of such materials.

8736 (EPRI-AP—4259-SR-Vol.2, pp 33.1-33.12) **Results of field testing of process for removing H_2S by condensing and re-evaporating geothermal steam at Cerro Prieto.** Angulo, R.; Lam, L.; Gonzalez, J.; Hughes, E.E. (Instituto de Investigaciones Electricas, Mexico). Aug 1987. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88920017/JAW. (CONF-8506369—Vol.2).

From 9. annual geothermal and second IIE-EPRI geothermal conference and workshop; San Diego, CA, USA (25 Jun 1985).

This paper describes the results of field testing of a process for removing gases from geothermal steam, based on condensation and re-evaporation of the steam in a shell-and-tube heat exchanger, upstream from the generator. The gases that are removed are blown off with a small amount of the steam fed in the process, and the final product is steam with a low concentration of H_2S and CO_2, at a pressure slightly lower than that of the initial steam. The experimentation was carried out with separated steam from well M-42 of the Cerro Prieto geothermal field. The equipment was previ-

ously tested at Los Geysers, California, USA. From January to November 1984, more than 200 gas removal tests were carried out, for a total of 3300 hours of operating time for the equipment. A pressure range from 60 to 140 psig was covered. 5 references, 9 figures, 1 table.

1508 Geothermal Power Plants

REFER ALSO TO CITATION(S) 8719, 8726, 8734, 8735, 10026

8737 (EPRI-AP—4259-SR-Vol.2, pp 6.1-6.13) **Initial operating results: Blundell geothermal 20 MW single flash plant.** Brown, D.R. (Utah Power & Light Co., Salt Lake City). Aug 1987. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88920017/JAW. (CONF-8506369—Vol.2).

From 9. annual geothermal and second IIE-EPRI geothermal conference and workshop; San Diego, CA, USA (25 Jun 1985).

The development of the Roosevelt Hot Springs KGRA located in southwestern Utah near Milford in Beaver County began in earnest in 1974 when Phillips Petroleum obtained a lease and discovered a hydrothermal reservoir about 2000 feet from the surface with a temperature of 500°F, hot enough for commercial production. As previously reported in earlier EPRI conferences, Utah Power & Light Company entered into a contract with Phillips Petroleum for the purchase of geothermal steam and with the intent of building a 20 MW plant as the first step toward development of this geothermal field for electric power generation. The Blundell Geothermal Plant was recently completed by Utah Power & Light and has demonstrated promising initial results, in spite of particular operating problems encountered. This paper focuses on the initial operating experience of the geothermal plant and indicate the present course of action being taken by Utah Power & Light principally, as well as Phillips Petroleum, in optimizing plant performance. 6 figures, 3 tables.

8738 (EPRI-AP—4259-SR-Vol.2, pp 7.1-7.9) **Operation of the five units at the Cerro Prieto I geothermal power plant.** Gibson, J.J. (Comision Federal de Electricidad, Mexico). Aug 1987. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88920017/JAW. (CONF-8506369—Vol.2).

From 9. annual geothermal and second IIE-EPRI geothermal conference and workshop; San Diego, CA, USA (25 Jun 1985).

Since 1973, the Comision Federal de Electricidad (CFE) (Federal Electricity Commission) has been operating continuously the Cerro Prieto I (CPU) geothermal power plant. The first of the two units included in the original project was placed in commercial operation during the month of April of that year. Three other units were installed in two later stages of the project. At the present time, the power plant has 5 units: 4 are rated at 37.5 MW each, and 1 is rated at 30 MW. The units provide an important part of the electrical energy needs of the Tijuana-Mexicali system that supplies electricity to the state of Baja California and part of Sonora. The paper describes the steam supply, the power generation process, and operating problems and their solution. 4 figures, 3 tables.

8739 (EPRI-AP—4259-SR-Vol.2, pp 9.1-9.38) **Operation of surface equipment for recovery of geothermal fluids at Cerro Prieto I.** Manon, A.; Bermejo, F.; Perez, P. (Federal Electricity Commission, Mexico). Aug 1987. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88920017/JAW. (CONF-8506369—Vol.2).

From 9. annual geothermal and second IIE-EPRI geothermal conference and workshop; San Diego, CA, USA (25 Jun 1985).

At Cerro Prieto I, 10 million MWh have been generated and 300 million tons of geothermal fluid have been produced. The length of the present system of 12- to 14-inch steam pipes is 24,000 m. The 8- to 16-inch water pipe system is 46,500 m. There are in operation 32 wells, 41 separators, 51 silencers, 7 steam dryers, and 290 8- to 16-inch diameter valves. Corrosion in the pipes and surface equipment has not been a serious problem. The principal maintenance problem has been the cleaning of the incrustations and sediments of silica in pipes, equipment, and channels. Frequent maintenance is necessary in order to maintain the capacity of the water pipes, of the separators and of the channels. The pipes of the wells, and in some cases of the deposit itself, have been affected by the incrustations. Even the small amounts of silica that are carried by the separated steam cause scales in the turbines, diminishing their capacity. During the time since the Cerro Prieto I Plant has been in operation, the deposit has yielded more than 150,000 tons of silica dissolved in the water, of which a small amount is deposited in the pipes, equipment, and channels, most of it being discharged in the evaporation pond. 16 figures, 14 tables.

8740 (EPRI-AP—4259-SR-Vol.2, pp 10.1-10.7) **HGP-A generator facility: reservoir characteristics and operating history.** Thomas, D. (Univ. of Hawaii at Manoa, Honolulu). Aug 1987. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88920017/JAW. (CONF-8506369—Vol.2).

From 9. annual geothermal and second IIE-EPRI geothermal conference and workshop; San Diego, CA, USA (25 Jun 1985).

The HGP-A Geothermal Wellhead Generator Facility, located on the Lower East Rift Zone of Kilauea Volcano, was installed as a pilot project to demonstrate the technical feasibility of producing electrical power from the geothermal reservoir discovered by the HGP-A research well in 1976. The electrical generation facility was installed in June, 1981 and, after a number of initial startup problems, began commercial operation in March 1982; it has now been in operation for nearly 40 months. During this period a number of changes have occurred in the well fluid chemistry that have yielded insight into the character of the geothermal reservoir associated with the East Rift Zone and have identified a number of potential operating problems, for future geothermal facilities that may be installed on this reservoir. These changes and their implications are discussed. 2 references, 3 figures.

8741 (EPRI-AP—4259-SR-Vol.2, pp 11.1-11.21) **Effects of high noncondensible gas loads on geothermal surface condensers - a case study.** Matteson, M.B.; Starnes, G.L. (Pacific Gas and Electric Co., San Francisco, CA). Aug 1987. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88920017/JAW. (CONF-8506369—Vol.2).

From 9. annual geothermal and second IIE-EPRI geothermal conference and workshop; San Diego, CA, USA (25 Jun 1985).

The large concentration of noncondensible gases present in the geothermal steam fields at The Geysers complex of power plants poses unique problems to condenser design. Proper venting of these gases from the condenser is critical to prevent poor condenser performance. This paper describes the testing of the internal gas removal design and the associated venting equipment of the surface condenser at Pacific Gas and Electric Company's Geysers Unit 15 Power Plant. Findings indicate that the gases are not being properly vented, resulting in a large area of gas blanketed tubes. In this gas blanketed region, the heat transfer is severely reduced so that this tube surface is no longer functioning to condense steam. The ultimate result of this gas blanketing is to reduce the performance of the condenser below the level which would be expected in the absence of this high noncondensible gas load. 15 references, 14 figures, 4 tables.

8742 (EPRI-AP—4259-SR-Vol.2, pp 12.1-12.7) **Operation of the mobile units of Los Azufres.** Pierres, L.O. (Comision Federal de Electricidad, Michoacan, Mexico). Aug 1987. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88920017/JAW. (CONF-8506369—Vol.2).

From 9. annual geothermal and second IIE-EPRI geothermal conference and workshop; San Diego, CA, USA (25 Jun 1985).

Five mobile turbogenerator units were installed at the geothermal field of Los Azufres, Michoacan, in 1982, each with a capacity of 5 MW. Since the start of operations, the performance of these units has been observed in order to determine their functioning and at the same time to learn the problems associated with the large scale operations of this geothermal field. This paper briefly describes the system and arrangement used, as well as the strategy at the origin of this project. Moreover, tables are presented giving the updated information on the energy generated and the installation factors for each unit, mentioning the principal problems that have been encountered. 4 references, 3 figures, 3 tables.

8743 (EPRI-AP—4259-SR-Vol.2, pp 13.1-13.7) **Design, start-up, and operation of SMUGEO #1.** Kleinhans, P.V.; Prideaux, D.L. (Stone & Webster Engineering Corp., Denver, CO). Aug 1987. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88920017/JAW. (CONF-8506369—Vol.2).

From 9. annual geothermal and second IIE-EPRI geothermal conference and workshop; San Diego, CA, USA (25 Jun 1985).

The Sacramento Municipal Utility District's (SMUD) first geothermal power plant, SMUDGEO #1, has recently completed its first year of commercial operation. The unit, located in The Geysers area of Northern California, has a design rating of 72.3 MW(e) gross at 1.5 in HgA. The selection of equipment and design of systems was greatly affected by the steam sales agreement. Purchase of steam on a per pound basis dictated that the plant be designed with the most efficient cycle possible. Likewise, the equipment was specified to insure maximum steam utilization. The Test and Start-up Program documentation was created to ensure that all equipment and systems met the engineering specifications, proved operational, and were satisfactory for commercial operation. This paper reviews the first year of unit operations, comparing system and unit design and predicted performance with actual performance. The unit's high availability and capacity factors are evidence that the decisions for designing a high efficiency unit and invoking a rigorous Test and Start-up Program are justified. 4 references, 4 figures, 2 tables.

8744 (EPRI-AP—4259-SR-Vol.2, pp 14.1-14.7) **5 MW geothermal turbogenerators specifications.** Lima, A.P.; Lopez, S.M. (Comision Federal de Electricidad, Michoacan, Mexico). Aug 1987. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88920017/JAW. (CONF-8506369—Vol.2).

From 9. annual geothermal and second IIE-EPRI geothermal conference and workshop; San Diego, CA, USA (25 Jun 1985).

This article presents the important concepts that must be considered in order to specify 5 MW geothermal turbogenerator units correctly, according to the objectives of their operation, and determining their general characteristics. Also included are the standards and codes that are applicable to the design and fabrication of the units, the materials that may be used and the tests to be performed on the machine and other components.

8745 (EPRI-AP—4259-SR-Vol.2, pp 24.1-24.4) **Integrating geothermal power plant design with steam field operation for an 80 MW plant in the geysers.** McKay, G.D.; Tucker, R.E. (Stone & Webster Engineering Corp., Denver, CO). Aug 1987. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88920017/JAW. (CONF-8506369—Vol.2).

From 9. annual geothermal and second IIE-EPRI geothermal conference and workshop; San Diego, CA, USA (25 Jun 1985).

This paper describes how a capacity factor of almost 100% has been attained by carefully matching the plant design and operation with the resource. Generally, it discusses how geothermal steam well fields and steam turbines are related in terms of performance and efficiency. The Sante Fe Geothermal (formerly Oxy Geothermal) plant is used as an example of designing and operating the plant and wells in an integrated fashion. In this plant two 100% turbine generators are installed so that full plant output can be achieved when one unit is inoperable by increasing throttle pressure from 100 psig to 150 psig. 3 references, 5 figures.

8746 (EPRI-AP—4259-SR-Vol.2, pp 26.1-26.4) **Start-up and testing of the Heber Binary Plant: an update.** Solomon, N.G.; Allen, R.F. (San Diego Gas & Electric, CA). Aug 1987. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88920017/JAW. (CONF-8506369—Vol.2).

From 9. annual geothermal and second IIE-EPRI geothermal conference and workshop; San Diego, CA, USA (25 Jun 1985).

The purpose of the Heber Binary Project is to design, construct, and demonstrate a nominal 65MW (gross) geothermal power plant utilizing the binary cycle to prove the technical, economic, and environmental viability of binary cycle geothermal power generation. The availability of binary cycle technology on a commercial scale will permit the future development of moderate-temperature (below 400°F) geothermal reservoirs, which represent about 80% of the geothermal resources in the US. SDG & E has developed Start-up and Testing Plans which will result in accurate and reliable plant and equipment performance data and accomplish the following Project objectives: determine the operational and performance characteristics of the Heber Binary Power Plant, its equipment, and the geothermal reservoir over a wide range of conditions; develop data bases for plant, equipment, and materials performance over the entire demonstration phase of the Project; confirm operation of plant systems and components in accordance with design criteria; and determine the optimum operating conditions for this plant and gather design information for improvement in designs for future plants. This paper presents an update on the current status of systems start-up and testing at the plant and discuss the upcoming planned testing activities. 5 figures.

8747 (EPRI-AP—4259-SR-Vol.2, pp 27.1-27.7) **Engineering of field installations of geothermal power plants.** Ramirez, R.G. (Instituto de Investigaciones Electricas, Mexico). Aug 1987. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88920017/JAW. (CONF-8506369—Vol.2).

From 9. annual geothermal and second IIE-EPRI geothermal conference and workshop; San Diego, CA, USA (25 Jun 1985).

This paper describes some of the activities of the Division of Engineering Studies of the Institute of Electrical Investigations in collaboration with the Comision Federal de Electricidad with the object of incrementing the existing geothermal electrical generation capacity in Mexico. The projects have been classified as follows: basic engineering development for geothermal plants; detail engineering for geothermic fluid handling systems; and theoretical and experimental studies for the equipment and systems required for the proper development of geothermal energy sources. 2 references.

8748 (EPRI-AP—4259-SR-Vol.2, pp 28.1-28.22) **Current status of engineering, construction, and start-up of the Heber double-flash geothermal power plant.** Willett, R.F.; Bickerstaffe, J.A.; Haag, L.B. (Gibbs & Hill, Inc., San Jose, CA). Aug 1987. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88920017/JAW. (CONF-8506369—Vol.2).

From 9. annual geothermal and second IIE-EPRI geothermal conference and workshop; San Diego, CA, USA (25 Jun 1985).

The Heber geothermal project, the largest double-flash power plant (52 MW) in the US, is currently in the final phases of engineering, construction, and start-up near El Centro in the Imperial Valley of California. This paper includes the major highlights of the engineering/design, construction, and start-up phases of the project and is the second paper in a series covering this development. The first paper includes the project history, participants, organization structure, financing, schedule, scope, and technical parameters. Initial turbine-generator roll and synchronization with the Imperial Irrigation District (IID) transmission system is targeted for late June 1985. 1 reference, 16 figures.

8749 (EPRI-AP—4259-SR-Vol.2, pp 29.1-29.5) **Binary cycle studies.** Najar, E.R. (Instituto de Investigaciones Electricas, Mexico). Aug 1987. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88920017/JAW. (CONF-8506369—Vol.2).

From 9. annual geothermal and second IIE-EPRI geothermal conference and workshop; San Diego, CA, USA (25 Jun 1985).

This paper presents a scenario of the application possibilities of the binary cycles for the utilization of geothermal energy from the low enthalpy sources existing in Mexico. It includes some of the results of the activities and studies that have been performed regarding the generation of electricity from binary cycles. The following are some of the most important ones: selection of the most promising working fluid; the best utilization of brine; the process of energy conversion; and the analysis tools used in these studies. The technical advances in the theoretical and experimental studies of tube and shield type heat exchangers for the utilization of the heat obtained from the geothermal fluid are also described.

8750 (EPRI-AP—4259-SR-Vol.2, pp 30.1-30.9) **Northern Nevada geothermal developments and the 9 MW(e) power plant at Desert Peak.** Blockley, W.E.; Gonser, W.C. (Sierra Pacific Power Co., Reno, NV). Aug 1987. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88920017/JAW. (CONF-8506369—Vol.2).

From 9. annual geothermal and second IIE-EPRI geothermal conference and workshop; San Diego, CA, USA (25 Jun 1985).

In late 1983, Sierra Pacific Power Company negotiated power purchase agreements with three geothermal development firms. The agreements established Sierra's desire to assess the technology and resource risks associated with geothermal energy in their energy resource planning process. The terms of the three agreements, approved by the Public Service Commission of Nevada in July of 1984, provide for the purchase of electrical energy produced by the pilot plants and substantial technology transfer. The aggregate plant capacity of 24 MW(e) is scheduled to begin operation during the period 1985 through 1987. A project at Steamboat Springs and one at Big Smokey Valley are briefly described. The third project at Desert Peak, 65 miles northeast of Reno is described in detail. 5 figures, 3 tables.

8751 (EPRI-AP—4259-SR-Vol.2, pp 31.1-31.6) **Basic considerations on incrustations in the design and operation of geothermoelectric power plants.** Hurtado, R.; Damian, F.; Bermejo, F. (IIE, Cuernavaca, Mexico). Aug 1987. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88920017/JAW. (CONF-8506369—Vol.2).

From 9. annual geothermal and second IIE-EPRI geothermal conference and workshop; San Diego, CA, USA (25 Jun 1985).

Knowledge of incrustation phenomena is basic to the design and efficient operation of power plants that use geothermal energy. Incrustations must be evaluated from the initial phase of the project. This is during the exploration stage when representative reservoir fluid is available for the purpose of determining: (1) the feasibility of the project, (2) the appropriate process, and (3) maintenance programs. Evaluation of incrustations implies the following activities: (1) complete characterization of the geothermal fluid, (2) characterization of the incrustations, (3) characterization of the reservoir, (4) determination of the rate of incrustation, and (5) evaluation of methods of control. The prediction of rates of incrustation formation is one of the most useful tools for selecting the process for a geothermoelectric plant. Nevertheless, little progress has been made in this area. Several general recommendations are included for engineers and scientists who design and operate geothermoelectric plants, as well as some methods of incrustation control.

8752 (EPRI-AP—4259-SR-Vol.2, pp 32.1-32.3) **Design, construction, and operation of the Mammoth geothermal power plant.** Campbell, R.G.; Holt, B. (Ben Holt Co., Pasadena, CA). Aug 1987. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88920017/JAW. (CONF-8506369—Vol.2).

From 9. annual geothermal and second IIE-EPRI geothermal conference and workshop; San Diego, CA, USA (25 Jun 1985).

The Mammoth Geothermal Project is located within the Long Valley Known Geothermal Resources Area (KGRA) on the eastern slope of the Sierra Nevada mountain range of California some 300 miles north of Los Angeles. Three miles west of the plant is the village of Mammoth Lakes, a well-known winter and summer resort. Field construction of the power plants was minimized by the use of modular design. Two identical units were built, side by side, with common utilities and common spare equipment. This paper describes the reservoir, design criteria, the Rankin cycle system, and construction of the plants. The operating history of the wells, the plant, the isobutane pumps, the brine-isobutane heat exchangers, air coolers, and the turbine-generators is discussed. Economics are briefly mentioned.

8753 (EPRI-AP—4259-SR-Vol.2, pp 38.1-38.6) **Results from wellhead development projects.** Hughes, E.E. (Electric Power Research Institute, Palo Alto, CA). Aug 1987. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88920017/JAW. (CONF-8506369—Vol.2).

From 9. annual geothermal and second IIE-EPRI geothermal conference and workshop; San Diego, CA, USA (25 Jun 1985).

A wellhead power system is one that utilizes the flow from a single well or a pair of adjacent wells to generate electrical power right at the wellhead, eliminating the need to transport the hot geothermal fluid from well to plant and having a plant size small enough to facilitate use of shop-fabricated, truck-transportable major subsystems or components. Wellhead systems will be in the 1 to 10 or 15 MW(e) size range. Current projects being performed as part of the wellhead systems subprogram in the EPRI Geothermal Power Systems Program are described below. These projects involve development of the following technologies: rotary separator turbine (RST), upstream reboiler for noncondensable gas removal, combustion-geothermal hybrid and modular wellhead binary. 19 references, 2 figures.

8754 (EPRI-AP—4259-SR-Vol.2, pp 39.1-39.14) **Research on fluidized-bed heat exchangers.** Siqueiros, J.; Heard, C.L.; Hernandez, H. (Instituto de Investigaciones Electricas, Mexico). Aug 1987. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88920017/JAW. (CONF-8506369—Vol.2).

From 9. annual geothermal and second IIE-EPRI geothermal conference and workshop; San Diego, CA, USA (25 Jun 1985).

Binary Cycle (Rankine organic cycle) electrical generating plants have been used in order to improve the utilization of the geothermic resources. In these plants, the heat exchangers can suffer serious incrustation problems if the brine has a high level of dissolved solids. Several types of exchangers have been proposed to avoid this problem, including the fluidized bed, direct contact, and multistage (flash) types. The fluidized bed heat exchangers (ICLF in Spanish) present good characteristics for the transfer of heat. The presence of fluidized particles increases the heat transfer velocity. On the other hand, these particles with their constant movement erode the exchanger surfaces which permits the formation of incrustations. At the same time, the solids are deposited on the sand particles instead of on the exchange surfaces. In this manner, the solids deposited on the sand particles can be obtained as a subproduct, mainly silica (SiO_2). Another advantage of the ICLF is the reduction of the incrustation problems in the reinjection geothermic wells once the silica content in the brine has been reduced. Using the ICLF, the energy in the geothermic brine can be utilized in nonelectric uses, such as heat pumps and in absorption-type refrigerators, where the heat transfer from the brine to other fluids (working fluids) is accomplished through an ICLF. 19 references, 7 figures.

8755 (EPRI-AP—4259-SR-Vol.2, pp 42.1-42.16) **Worldwide geothermal power development.** DiPippo, R. (Southeastern Massachusetts Univ., Dartmouth). Aug 1987. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88920017/JAW. (CONF-8506369—Vol.2).

From 9. annual geothermal and second IIE-EPRI geothermal conference and workshop; San Diego, CA, USA (25 Jun 1985).

Up to the year 1978, geothermal power development had progressed with an average annual growth rate of about 8.3%. From 1978 to the present the growth rate has been about 17%. Most of the increase has been due to power plant activity in three countries: the Philippines, the US, and Mexico. If that rate of growth were to continue, then there would be about 10,000 MW of geothermal power on-line by the end of this decade. However, there are indications that a significantly lower growth rate will take hold for at least the next five years. A summary is given of the present status (i.e., through 1985) and projected developments out to the year 1994 for those countries that now have operating plants and those that might reasonably be expected to have plants during the next 10 years. Based on information available at this time, the cumulative potential geothermal power capacity is about 10,114 MW. It seems likely that an annual growth rate of about 6% will apply for the rest of the 1980s. The rate could increase in the 1990s should the Philippines resume their initial rapid development of their impressive geothermal resources. This paper focuses on geothermal power plant activities in the following countries: the US, Mexico, Japan, New Zealand, Nicaragua, and Indonesia. 2 references, 6 figures, 14 tables.

1509 Geothermal Engineering

REFER ALSO TO CITATION(S) 8719, 8739

8756 (EPRI-AP—4259-SR-Vol.2, pp 5.1-5.4) **Overview of DOE geothermal program - 1985.** Toms, R.S.H. (Dept. of Energy, Washington, DC). Aug 1987. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88920017/JAW. (CONF-8506369—Vol.2).

From 9. annual geothermal and second IIE-EPRI geothermal conference and workshop; San Diego, CA, USA (25 Jun 1985).

The work on the future resources of hot dry rock, geopressure and magma will provide industry with the data to exploit these enormous geothermal resources, once the higher grade hydrothermal reservoirs have been developed. Meanwhile the thrust of DOE research toward a second-generation binary system forms the focal point for much generic research and will increase the exploitable resources considerably over the next decade. Improvements in flash systems are likely to be made independently by the industry itself as it finds better answers to handling high-salinity brines and higher-efficiency cycles than the one- or two-stage flash systems in use at present. They can expect to see increased cost-sharing of technology development projects as industry gains confidence and identifies new concepts for solving the problems that cause high costs. Together, the Federal government and the geothermal industry can achieve the expected level of 5000 MW on line by the year 2000 and may possibly reach the level of 6000 MW suggested in the forthcoming 1985 EPRI Survey of Electric Utilities by Paul Kruger and Vasel Roberts. 2 tables.

8757 (EPRI-AP—4259-SR-Vol.2, pp 18.1-18.33) **Meager Creek geothermal project: report on activities for 1984/85.** Stauder, J. (British Columbia Hydro & Power Authority, Vancouver). Aug 1987. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88920017/JAW. (CONF-8506369—Vol.2).

From 9. annual geothermal and second IIE-EPRI geothermal conference and workshop; San Diego, CA, USA (25 Jun 1985).

The Meager Creek Project area is located approximately 200 km north of Vancouver in the rugged Coast Mountains of southwest B.C. Geothermal investigations at Meager Creek have been in progress since late 1973. Exploration culminated with the drilling of three, large diameter rotary holes during 1980 to 1982. The program resulted in one well, MC-1, capable of long-term, sustained steam production. The two other wells, although unable to produce steam spontaneously in their present state, have been invaluable in the development of interpretive models for the geothermal reservoir. This paper describes the results and evaluations of the testing and monitoring of these three wells during 1983-85. Described are pressure and flow measurements, well blockage, temperature measurements, well chemistry, lost equipment & recovery, airlifting to stimulate the wells, and the preparation, installation, and testing of a 20 kW demonstration turbine.

8758 (EPRI-AP—4259-SR-Vol.2, pp 34.1-34.7) **Demonstration of geothermal scale control using a flash crystallizer.** Brugman, J.R.; Brown, D.R. (Ben Holt Co., Pasadena, CA). Aug 1987. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88920017/JAW. (CONF-8506369—Vol.2).

From 9. annual geothermal and second IIE-EPRI geothermal conference and workshop; San Diego, CA, USA (25 Jun 1985).

One of the major impediments to the further exploitation of the large hydrothermal resource in western North America is the tendency of this fluid to deposit mineral scale in piping and equipment. This is especially true of the hotter resources. EPRI has conducted a research program for several years with the objective of determining the feasibility of reducing geothermal power plant outage rates by 50% through the use of systematic scale control measures. The flash crystallizer concept is one candidate scale control technique. A pilot scale test facility was designed and a crystallizer specification was developed. The test facility was designed to be 1/100th of the size of a commercial unit. It was also designed to accommodate brines from a variety of geothermal sites. This paper describes the crystallizer test facility and proposed field tests. 3 references, 5 figures.

8759 (EPRI-AP—4259-SR-Vol.2, pp 35.1-35.15) **Analysis and testing of hot and pressurized underground piping.** Tello, M.A. (Instituto de Investigaciones Electricas, Mexico). Aug 1987. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88920017/JAW. (CONF-8506369—Vol.2).

From 9. annual geothermal and second IIE-EPRI geothermal conference and workshop; San Diego, CA, USA (25 Jun 1985).

In order to collaborate with CFE in the search for an adequate technical and economic solution to the conduction of fluids in a geothermal field, IIE developed a project called Underground Piping, in which were studied various aspects of the design of this type of system, such as: pipe materials, earth fill, insulation, organic inhibition, external corrosion, and most especially mechanical and thermal analysis. Finally, there were brought together a series of labors on this subject, operating and building experience in other sectors and countries, and applicable standards, for the purpose of developing a methodology that combines soil mechanics with structural analysis of piping. In order to verify performance under real operating conditions, underground piping was constructed for testing in the Geothermal field of Los Azufres, which was analyzed experimentally with the support of LAPEM. This paper discusses the results of these studies. 7 references, 5 figures, 1 table.

8760 (EPRI-AP—4259-SR-Vol.2, pp 40.1-40.19) **Bottomwell testing of geothermal cements.** Barroso, G.H.; Morales, J.M. (Instituto de Investigaciones Electricas, Mexico). Aug 1987. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88920017/JAW. (CONF-8506369—Vol.2).

From 9. annual geothermal and second IIE-EPRI geothermal conference and workshop; San Diego, CA, USA (25 Jun 1985).

The Committee for the standardization of geothermal cements of the American Petroleum Institute (API) and of the Comision Federal de Electricidad (Federal Electricity Commission) (CFE) performed a series of tests to evaluate 15 cement compounds of foreign development and one developed in this country by the Instituto de Investigaciones Electricas (Institute of Electrical Research) (IIE) in the Cerro Prieto geothermic field. The object of these tests was to select the compounds with the best permeability and compression resistance after a period of 1 day, 3, 6 and 12 months in a real geothermic environment. The CFE provided the well and performed the necessary operations for the introduction and extraction of the samples, and the IIE coordinated the experimental work. Two laboratories were chosen for the final evaluation of the cements: the NBS in Washington, USA, and the IIE in Cuernavaca, Mor., Mexico. A number of samples were placed in baskets and introduced in the Q-757 well to a depth of 700 meters, where the temperature reaches 214°C and the pressure 1100 lb/sq. in. Other samples were placed in superficial chambers designed by the IIE and were mixed with brine from the same well at a temperature of 170°C and a pressure of 110 lb/sq. in. This paper presents the results obtained by the IIE in Mexico. 9 references, 6 figures, 6 tables.

1520 Geothermal Data And Theory

REFER ALSO TO CITATION(S) 8740, 8740

8761 (EPRI-AP—4259-SR-Vol.2, pp 22.1-22.8) **Radon as an in-situ tracer in geothermal reservoirs.** Semprini, L.; Kruger, P. (Stanford Univ., CA). Aug 1987. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88920017/JAW. (CONF-8506369—Vol.2).

From 9. annual geothermal and second IIE-EPRI geothermal conference and workshop; San Diego, CA, USA (25 Jun 1985).

A study of the relationship between radon concentration and spacial and temporal variations of thermodynamic conditions in the Cerro Prieto reservoir was reported by Semprini and Kruger (1984). Based on two surveys of some twenty wells taken two years apart, they noted by contour analysis that the distribution of wellhead radon concentration was reasonably congruent with the distribution of fluid enthalpy and that the observed shift in high radon concentration towards the northeast section of the field was accompanied by a corresponding shift in the fluid enthalpy. Over the past

two years, two additional surveys were completed at the Cerro Prieto field. The data were used to reexamine the mapping of radon concentration and fluid enthalpy contours and the correlations between radon concentration and reservoir conditions in the reservoir. During this period emanation measurements were made with core materials obtained from CFE. This report summarizes the results of the four field surveys at Cerro Prieto, evaluation of the data by contour and regression analysis, comparison of the correlations at other fields, and results of emanation measurements to estimate the volumetric emanation coefficients. A number of simulations of radon transport in two-phase reservoirs were completed. The results of these investigations and their impact on assessing the role of radon as an in-situ tracer of geothermal conditions are summarized. 21 references, 4 figures, 1 table.

17 WIND ENERGY

1705 Environmental Aspects

8762 **(SERI/TP—217-3261) A proposed metric for assessing the potential of community annoyance from wind turbine low-frequency noise emissions.** Kelley, N.D. (Solar Energy Research Inst., Golden, CO (USA)). Nov 1987. Contract AC02-83CH10093. 11p. (CONF-871062—8). NTIS, PC A03. Order Number DE88001113/JAW.

From Windpower '87; San Francisco, CA, USA (5 Oct 1987).

Given our initial experience with the low-frequency, impulsive noise emissions from the MOD-1 wind turbine and their impact on the surrounding community, the ability to assess the potential of interior low-frequency annoyance in homes located near wind turbine installations may be important. Since there are currently no universally accepted metrics or descriptors for low-frequency community annoyance, we performed a limited program using volunteers to see if we could identify a method suitable for wind turbine noise applications. We electronically simulated three interior environments resulting from low-frequency acoustical loads radiated from both individual turbines and groups of upwind and downwind turbines. The written comments of the volunteers exposed to these interior stimuli were correlated with a number of descriptors which have been proposed for predicting low-frequency annoyance. The results are presented in this paper. We discuss our modifications of the highest correlated predictor to include the internal dynamic pressure effects associated with the response of residential structures to low-frequency acoustic loads. Finally, we outline a proposed procedure for establishing both a low-frequency "figure of merit" for a particular wind turbine design and, using actual measurements, estimate the potential for annoyance to nearby communities. 10 refs., 13 figs., 7 tabs.

1706 Wind Energy Engineering

8763 **(BMFT-FB-T—86-194) Design of a conception, and execution of a measuring program, as well as installation and putting into operation of a digital system for measurement data acquisition and processing for the project 'Windpark Kythnos'. Final report.** Cramer, G.; Caselitz, P.; Hackenberg, G.; Kleinkauf, W.; Amann, T.; Pernpeintner, R. (Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.); SMA System-, Mess- und Anlagentechnik - Regelsysteme G.m.b.H., Niesetal (Germany, F.R.)). Dec 1986. 210p. (In German). NTIS (US Sales Only), PC A10/MF A01. Order Number DE88750518/JAW.

Installation and putting into operation of the measurement data acquisition system in the control room of the windpark, and in the island's power station building, were finished August, 1983. In cooperation with the Gesamthochschule Kassel additional series of measurements were carried out to test the several plants, and the dynamical action of the windpark. Continuous measurement data acquisition was carried out during the whole project life. The measurement results of typical and of especially interesting days were graphically represented. Monthly and yearly data collection, and investigations in the availability of the wind energy plants were carried out. The measurements have confirmed that direct coupling of a windpark with a weak electrical power supply grid on 3-phase AC side doesn't cause problems regarding grid stability. Due to the taken control measures inadmissible operation states of the diesel aggregates could be prevented, and a very high partition of the windpark (windpark power 100 kW with only 25 kW diesel power) could be realized at small consumer power. A future increase of the installed windpark power might therefore lead to an increased fuel saving without problems with the electrical stability. With 3 refs., 143 figs..

8764 **(BMFT-FB-T—86-209) Development and testing of a direct coupling of an uncontrolled wind power station with a vapor compression plant for seawater desalination. Phase 1. Technical feasibility study and constructive preliminary studies. Final report.** Danninger, W.; Wimberger, H.J.; Banzhaf, H.U.; Cramer, G. (Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.); Gesellschaft fuer Technische Studien, Entwicklung, Planung G.m.b.H. (SEP), Muenchen (Germany, F.R.); Voith (J.M.) G.m.b.H., Heidenheim (Germany, F.R.); SMA System-, Mess- und Anlagentechnik - Regelsysteme G.m.b.H., Niesetal (Germany, F.R.)). Dec 1986. 147p. (In German). NTIS (US Sales Only), PC A07/MF A01. Order Number DE88750516/JAW.

The coupling of an uncontrolled wind power station with a vapor compression plant to desalinate seawater was examined. After compiling the process concept, simulating calculations on the plant's performance in service were carried out and the constructive design of a vapor compression plant for special application with a wind energy converter determined. The calculation results showed that the load management of an uncontrolled wind energy converter can be achieved with a specially designed vapor compression plant. A further result is that the available wind power can be well exploited for high wind speeds as well by means of a simple control intervention in the water/vapor circuit. This can be achieved by limiting the performance by speed regulation utilizing the aerodynamical stall effect. The implemented technical preliminary studies make it possible to construct a prototype plant for the experimental verification of the process. With 15 refs., 13 tabs., 45 figs..

20 ELECTRIC POWER ENGINEERING

8765 **(BMFT-FB-T—86-185-Pt.2) Reliability evaluation in electric power systems. Final report.** Edwin, K. (Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.); Technische Hochschule Aachen (Germany, F.R.). Lehrstuhl und Inst. fuer Elektrische Anlagen und Energiewirtschaft). Dec 1986. 409p. (In German). NTIS (US Sales Only), PC A18/MF A01. Order Number DE88770024/JAW.

Research papers dealing with electric power systems research in the Federal Republic of Germany are presented in two volumes. Separate abstracts were prepared for the papers in these volumes.

8766 **(NUREG/CR—5035) Data base of system-average dose rates at nuclear power plants: Final report.** Beal, S.K.; Britz, W.L.; Cohen, S.C.; Goldin, A.S.; Goldin, D.J. (Science and Engineering Associates, Inc., Albuquerque, NM (USA); SC and A, Inc., McLean, VA (USA); Nuclear Regulatory Commission, Washington, DC (USA). Div. of Regulatory Applications). Oct 1987. 75p. NTIS, PC A04/MF A01 - GPO. Order Number TI88900140/JAW.

In this work, a data base is derived of area dose rates for systems and components listed in the Energy Economic Data Base (EEDB). The data base is derived from area surveys obtained during outages at four boiling water reactors (BWRs) at three stations and eight pressurized water reactors (PWRs) at four stations. Separate tables are given for BWRs and PWRs. These tables may be combined with estimates of labor hours to provide order-of-magnitude estimates of exposure for purposes of regulatory analysis. They are only valid for work involving entire systems or components. The estimates of labor hours used in conjunction with the dose rates to estimate exposure must be adjusted to account for in-

field time. Finally, the dose rates given in the data base do not reflect ALARA considerations. 11 refs., 2 figs., 3 tabs.

2001 Power Plants And Power Generation

REFER ALSO TO CITATION(S) 8402, 8425

8767 **(EPRI-AP—5493) Combustion turbine repowering: Final report.** Oliker, I.; Silaghy, F.J. (Public Service Electric and Gas Co., Newark, NJ (USA); Burns and Roe Enterprises, Inc., Oradell, NJ (USA)). Nov 1987. 118p. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88920079/JAW.

The study discusses the findings of a conceptual site-specific investigation into the feasibility of repowering an existing reheat fossil unit utilizing combustion turbines. It identifies a potentially attractive repowering project, through the evaluation and selective elimination of a large number of alternatives. A conceptual design is performed on the selected alternative. Capital costs are developed for this alternative including new equipment and modifications to existing equipment. The results of an economic evaluation and sensitivity analysis are presented, to serve as a basis for a decision on whether or not to proceed with final design, procurement, and construction of the system. The steps presented in the report are intended to provide for the utility industry a detailed methodology for investigating repowering at a specific utility site. 4 refs., 21 figs., 15 tabs.

8768 **(NP—8750505) STEWEAG business report 1985.** (Steirische Wasserkraft- und Elektrizitaets-A.G. (STEWEAG), Graz (Austria)). 1986. 42p. (In German). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88750505/JAW.

The annual report abstracted informs about the situation of energy economy as well as about the STEWEAG activities in the operation, installation and maintenance of power plants and on the alternative energy sector. The report discusses the 1985 STEWEAG electric power production provided by the company's power generation in hydroelectric power plants, steam power plants, central heating plants and dual-purpose power plants. Moreover, it points out electric power supplies and uses. The report of the chair of the board is followed by balances along with the profit and loss account and a survey of STEWEAG plants.

2002 Environmental Control Technology

REFER ALSO TO CITATION(S) 9968

8769 **(CONF-870999—3) Projecting future deposition trends.** Streets, D.G.; Veselka, T.D. (Argonne National Lab., IL (USA)). 1987. Contract W-31109-ENG-38. 13p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88003045/JAW.

From 2. international processing and utilization of high-sulfur coal conference; Carbondale, IL, USA (28 Sep 1987).

As part of the environmental assessment of the US Department of Energy's Fifth National Energy Policy Plan (NEPP-5), Argonne National Laboratory projected emissions of sulfur dioxide (SO_x) and nitrogen oxides (NO/sub x/) out to the year 2030 and emissions of volatile organic compounds (VOC) to the year 2010. The projections indicated changes in emissions at the national level, but, more significantly, suggested a fundamental shift in regional emission patterns over the next 50 years. This paper examines the regional and sectoral distribution of these projected emissions and relates them to potential changes in deposition levels over the next 50 years. Specifically, changes in sulfur deposition in five sensitive areas are examined with the ASTRAP model of atmospheric transport, transformation, and deposition. Expected changes in regional emissions of NO/sub x/ and VOC are also presented, but their implications for deposition cannot be assessed quantitatively at this time due to limitations in the capabilities of current long-range transport models. 11 refs., 9 figs., 1 tab.

8770 **(CONF-870999—4) Projecting future SO/sub x/ emissions from coal-fired utility boilers.** Veselka, T.D.; Streets, D.G. (Argonne National Lab., IL (USA)). 1987. Contract W-31109-ENG-38. 15p. NTIS, PC A03. Order Number DE88002855/JAW.

From 2. international processing and utilization of high-sulfur coal conference; Carbondale, IL, USA (28 Sep 1987).

According to the Fifth National Energy Policy Plan (NEPP-5) the electric utility industry is forecast to significantly increase its coal use in the future. By 2010, coal use is expected to be approximately twice that of current levels. Since coal-fired power plants are a major source of SO/sub x/ emissions, there is some concern that large increases in coal use will result in higher SO/sub x/ emissions in the future. The Clean Air Act may not be stringent enough to ensure that emissions will not increase in the future. On the basis of NEPP-5 energy projections, SO/sub x/ emissions are projected from coal-fired power plants using the AIRCOST model. Base-case projections show that national-level SO/sub x/ emissions are expected to rise slightly above current levels through 2000 and then decline through 2025. Some regions of the country, however, are forecast to experience significant increases in SO/sub x/ emissions, while other regions may experience decreases. 10 refs., 4 figs., 2 tabs.

8771 **(DOE/PC/80539—T10) Heterogeneous removal of sulfur dioxide by hydroxide aerosols: Final technical report, September 15, 1985-September 14, 1987.** Stelson, A.W. (Atlanta Univ. Center, Inc., GA (USA). Dolphus E. Milligan Science Research Inst.). 14 Dec 1987. Contract FG22-85PC80539. 20p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88003206/JAW.

This project was designed to determine the ultimate suitability of atomized calcium, magnesium, potassium or sodium hydroxide in removing sulfur dioxide and nitrogen dioxide from synthetic coal combustor flue gases. This effort was to determine the scientific advantages of one hydroxide over another. Sulfur dioxide reacted with sodium hydroxide and potassium hydroxide at rates faster than calcium hydroxide. 11 refs., 2 figs., 3 tabs.

2003 Power Transmission And Distribution

8772 **(BMFT-FB-T—86-185-Pt.1) Reliability evaluation in electric power systems. Final report.** Edwin, K. (Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.); Technische Hochschule Aachen (Germany, F.R.). Lehrstuhl und Inst. fuer Elektrische Anlagen und Energiewirtschaft). Dec 1986. 461p. (In German). NTIS (US Sales Only), PC A20/MF A01. Order Number DE88750512/JAW.

1. Objective. Investigations of practicability for computation of reliability and necessary power reserve of generation systems; reliability and necessary transmission reserve of transmission systems as a tool for operation and expansion planning in electric power systems. 2. Results. In co-operation with the largest utilities of Germany (FRG): Analysis of available data base and of practicable investigations; developing suitable methods (modelling and programming); evaluation of model systems; answering concrete questions of operation and expansion planning for necessary generation and transmission reserve. 3. Gains caused by results. Generation reserve: The effects of system interconnection, of generation unit size, of maintenance strategies and others on necessary generation reserve can be calculated and assessed by costs; transmission reserve: The investigation of 380-kV-networks shows, how to identify system weak points being either the effect of changing power plant sites or of time delay in construction of generation units and transmission lines. Analysing 110-kV-networks the effects of topology, of substation design, of neutral earthing and others on system reliability can be quantified. With 175 refs., 107 tabs., 283 figs..

8773 **(CONF-880102—1) Spark decomposition of SF_6: Chemical and biological studies.** Griffen, G.D.; Sauers, I.; Kurka, K.; Easterly, C.E. (Oak Ridge National Lab., TN (USA)). 1987. Contract AC05-84OR21400. 24p. NTIS, PC A03/MF A01; GPO Dep. Order Number DE87014071/JAW.

From IEEE Power Engineering Society winter meeting; New York, NY, USA (31 Jan 1988).

Gas-insulated systems employing SF_6 are utilized in a variety of applications in power delivery systems. Because electric arcs, sparks or corona can decompose SF_6 into byproducts having chemical properties different from SF_6, environmental concerns arise regarding inadvertent human exposures to electrically-decomposed SF_6. Biological assays in our laboratory using mammalian cell culture systems have revealed that spark-decomposed SF_6 produces cell death, and the extent of cell killing increases with increasing spark energy. Chemical analysis of spark-decomposed SF_6 has identified the major decomposition pathways and byproducts, but biological testing of individual or byproduct mixtures has indicated that these major decomposition products do not contribute, in a significant fashion, to the cell lethality seen in our assays. Further experiments have suggested that S_2F_{10} may be produced under our decomposition conditions and that this compound may be a major contributor to the observed cell lethality. We have initiated testing of the genotoxic activity of spark-decomposed SF_6 using a biological mutation assay, and have so far obtained equivocal results, although some samples have produced a positive result. 27 refs., 4 figs., 4 tabs.

8774 **(DOE/CE/76250—1) Research progress in disturbance recognition and system impact evaluation: [Final technical report].** Mealy, G.L. (Analytic Sciences Corp., Reading, MA (USA)). 30 Oct 1987. Contract AC01-84CE76250. 53p. NTIS, PC A04. Order Number DE88002524/JAW.

Algorithms are developed to identify the occurrence of a major electric power system disturbance and to assess its impact on subsequent system operation. Approaches taken to achieve a goal of online implementation include: decomposition of the original system into smaller subsystems that are handled independently, development of a rule-based disturbance identification process embedded in a tracking state estimator for each subsystem used to identify the occurrence of a disturbance, and the development of key indicators (based upon a bifurcation theoretic approach to steady-state stability analysis) for assessing the effects of the disturbance. Algorithm performance and execution time are demonstrated using operating data obtained from the REMVEC 345 kV network. 16 refs., 14 figs., 9 tabs.

8775 **(EPRI-EL—4540-CCM-Vol.4) TLWorkstation code: Version 1.1: Volume 4, GATL user's manual.** Dawalibi, F.; Southey, R.D. (Safe Engineering Services and Technologies Ltd., Montreal, Quebec (Canada)). Nov 1987. 104p. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88920092/JAW.

The GATL Software Package consists of four computer programs dedicated to the grounding analysis of transmission lines: RESIST, LINPA, GTOWER, and PATHS. These programs are independent of one another, but are generally used in concert; they have therefore been designed with the efficient exchange of data between them in mind. The EPRI TLWorkstation prepares batch input files for each of the four GATL programs using a quickly mastered menu-driven user interface. Using this interface, the user not only prepares the input data files for the four programs, but also can manipulate, examine, and print input and output files, and run the GATL programs. The TLWorkstation interface for each of the programs consists essentially of a series of forms which must be completed by the user. The general conventions for completing these forms are described in the GATL User's Guide, as are detailed instructions for filling out each of the entries in these forms. 32 figs.

8776 **(EPRI-EL—4540-CCM-Vol.16) TLWorkstation code: Version 1.1: Volume 16, CUFAD [Compression and Uplift Foundation Analysis and Design] manual: Computer code manual.** Trautmann, C.H.; Kulhawy, F.H. (Cornell Univ., Ithaca, NY (USA). School of Civil and Environmental Engineering). Oct 1987. 130p. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88920104/JAW.

These manuals describe in detail the computer program CUFAD (Compression and Uplift Foundation Analysis and Design). This program was developed to evaluate the load-displacement behavior of spread foundations and both straight sided and belled drilled shaft foundations in soil. The program is quite versatile and can operate in either analysis or design modes. In general, the equations in the code follow those presented in EPRI Report EL-2870 and EL-3771, with modifications or extensions as noted herein. This is Volume 16 of an 18-volume report. 19 figs., 2 tabs.

8777 **(EPRI-EL—5488) Structural development studies at the EPRI Transmission Line Mechanical Research Center: Interim Report 2.** LeMaster, R.A. (Sverdrup Technology, Inc., Tullahoma, TN (USA)). Nov 1987. 246p. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88920094/JAW.

The objective of the Transmission Line Mechanical Research Center (TLMRC) Structural Development Project is to perform research which will complement and extend the existing knowledge associated with overhead-electrical-transmission structural systems. Work toward this objective will lead to more cost effective and reliable structural systems. The overall project is being accomplished by: (1) improving design and analysis software based on results obtained from full-scale structure tests conducted at the TLMRC; (2) maintaining a database on TLMRC test results; (3) evaluating new design methodologies; and (4) integrating structural analysis and design software into the EPRI TLWorkstation Software System. Research discussed in this report is divided into five primary technology areas. These technology areas are: (1) lattice structure; (2) tubular steel structures; (3) testing technology; (4) research lines; and (5) TLWorkstation software. Although an independent chapter is devoted to each of these technology areas, the research in one area is not independent of the others, and advances in one area often leads to advances in another area. 19 refs., 187 figs., 38 tabs.

21 NUCLEAR POWER PLANTS

2101 Power Reactors, Non-breeding, Light-water Moderated, Boiling Water Cooled

REFER ALSO TO CITATION(S) 8595, 8766, 8785, 8792, 8826, 8860, 8877, 8878, 8880, 8887, 8888, 8890, 8892, 8895, 8899, 8902, 8904, 8905, 8907, 8914, 8916, 8917, 8918, 8919, 8921, 8922, 8927, 8928, 8929, 8931, 8932, 8934, 8935, 8937, 8942

8778 **(CONF-870839—7) An overview of environmental degradation of materials in nuclear power plant piping systems.** Shack, W.J. (Argonne National Lab., IL (USA)). Aug 1987. Contract W-31109-ENG-38. 21p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88003025/JAW.

From 3. international symposium on environmental degradation of materials in nuclear power systems: water reactors; Traverse City, MI, USA (30 Aug 1987).

Piping in light water reactor (LWR) power systems is affected by several types of environmental degradation: intergranular stress corrosion cracking (IGSCC) of austenitic stainless steel piping in boiling water reactors (BWRs) has required research, inspection, and mitigation programs that will ultimately cost several billion dollars; erosion-corrosion of carbon steel piping has been observed frequently in the secondary systems of both BWRs and pressurized water reactors (PWRs); the effect of the BWR environment can greatly diminish the design margin inherent in the ASME Section III fatigue design curves for carbon steel piping; and cast stainless steels are subject to embrittlement after extended thermal aging at reactor operating temperatures. These problems are being addressed by wide-ranging research programs in this country and abroad. The purpose of this review is to highlight some of the accomplishments of these programs and to note some of the remaining unanswered questions.

8779 (CONF-8710111—7) Summary of HSST wide-plate crack-arrest tests and analyses. Naus, D.J.; Bass, B.R.; Keeney-Walker, J.; Fields, R.J.; deWit, R.; Low, S.R. III. (Oak Ridge National Lab., TN (USA); National Bureau of Standards, Washington, DC (USA)). 1987. Contract AC05-84OR21400. 25p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88002601/JAW.

From 15. water reactor safety information meeting; Gaithersburg, MD, USA (26 Oct 1987).

Eleven wide-plate crack-arrest tests have been completed to date, seven utilizing specimens fabricated from A533B class 1 material (WP-1 series), and four fabricated from a low upper-shelf base material (WP-2 series). With the exception of one test in the WP-1 series and two tests in the WP-2 series which utilized 152-mm-thick specimens, each test utilized a single-edge notched (SEN) plate specimen 1 by 1 by 0.1 m that was subjected to a linear thermal gradient along the plane of crack propagation. Test results exhibit an increase in crack-arrest toughness with temperature, with the rate of increase becoming greater as the temperature increases. When the wide-plate test results are combined with other large-specimen results (Japanese ESSO, thermal-shock experiments and pressurized-thermal-shock experiments), the data show a consistent trend in which the K/sub Ia/ data extends above the limit provided in ASME Section XI.

8780 (FEI—1819) Estimation of random deviation effect of pipeline geometry on hydraulic nonuniformity at reactor inlet. Yur'ev, Yu.S.; Buryak, O.V. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk. Fiziko-Ehnergeticheskij Inst.). 1986. 8p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88700845/JAW.

Approximate formula enabling to evaluate hydraulic nonuniformity at reactor core inlet is given. The mentioned nonuniformity depends on 13 structural parameters of reactor hydraulic pipeline - from branch pipes up to the header. Dispersion technique for evaluation of the effect of structural parameter deviation on the spread of resulting nonuniformity is applied to the dependence. Coefficients of the effect have been obtained. Calculation has been conducted for the example, the minimal flow rate in reactor channel has been evaluated as 0.65+-0.14. 11 refs.; 1 fig.

8781 (JAERI-M—87-128) Study on pellet-cladding interaction (PCI) of light water reactor fuel. Yanagisawa, Kazuaki. (Japan Atomic Energy Research Inst., Tokyo). Aug 1987. 90p. (In Japanese). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88751068/JAW.

This paper describes the summary of current knowledges for pellet-cladding interaction (PCI) of light water reactor fuels. Emphasis is made on the highlights of research about the following subjects: - Influence of fuel design parameters on PCI, - Influence of accumulated burn-up on PCI, - PCI behavior during load-follow simulated operation, - PCI failure threshold, with current 8 x 8 BWR and 17 x 17 PWR fuel rods. With respect to the subject on "PCI behavior during load-follow simulated operation", the followings are revealed: 1) The current 8 x 8 BWR and 17 x 17 PWR fuel rods showed no failure indication during load-follow simulated operation (linear power variated from 45 to 30 kW/m up to maximum cycles 826 times) carried out up to the burn-up of 18 MWd/kgU. 2) No apparent enhancement of PCI and fission product gas release due to power cyclings was observed.

8782 (NUREG/CR—5059) Void fraction measurement liquid level detection concept assessment and development. Mohr, C.L.; Reich, F.R.; Berrett, M.K.; Leggett, S.E.; Mohr, L.J. (Mohr and Associates, Richland, WA (USA)). Nov 1987. 82p. NTIS, PC A05/MF A01 - GPO. Order Number TI88900208/JAW.

The Coolant Inventory Monitor System for measuring the amount and the distribution of coolant in the primary system under accident conditions of a nuclear power plant is described in this report. This system is based on measuring the local void fraction of the coolant at selected points in the vessel and piping system and then estimating the coolant inventory. This report summarizes the development of the measurement instrument, the supporting tests and the development of the supporting software. Accuracies of +-2% as compared with delta pressure cells can be obtained over void fractions ranging from 0 to 90%. The system can provide local measurements of void fraction and uses probes as small as 0.015 x 1.0 x 0.3 in. (0.038 x 2.54 x 0.76 cm). Experimental test data are shown for temperatures up to 570°F (572K). The system can be used up to the critical point. The graphics display shows a real time display of void fraction for up to fifteen channels and gives the instantaneous as well as a running average for each channel. This instrument is believed to meet the intent of the NRC by being able to measure the amount of water above the reactor core under all types of accidents. 10 refs., 31 figs., 3 tabs.

2102 Power Reactors, Non-breeding, Light-water Moderated, Non-boiling Water Cooled

REFER ALSO TO CITATION(S) 8595, 8656, 8766, 8778, 8779, 8780, 8781, 8782, 8826, 8839, 8840, 8850, 8851, 8860, 8871, 8872, 8874, 8875, 8877, 8878, 8881, 8887, 8888, 8889, 8890, 8891, 8892, 8893, 8894, 8895, 8896, 8897, 8898, 8899, 8900, 8902, 8904, 8906, 8907, 8909, 8910, 8911, 8912, 8913, 8914, 8916, 8917, 8918, 8919, 8921, 8922, 8924, 8926, 8927, 8928, 8929, 8931, 8932, 8934, 8935, 8936, 8937, 8942, 8946, 9209, 9210, 9234, 9235

8783 (AERE-R—11974, pp 225-248) Iodine volatility from evaporating PWR primary coolant films. Handy, B.J. (National Nuclear Corp. Ltd., Whetstone, UK). Jan 1986. H.M. Stationery Office, London, price Pound 16.00. (CONF-8509169—).

From Specialist workshop on iodine chemistry in reactor safety organization for economic cooperation and development; Harwell, UK (9 Sep 1985).

This work describes iodine behaviour during SGTR faults in a PWR. Iodine volatility was measured from a film of iodide solution containing boric acid and lithium hydroxide. ^{131}I was used as a radioactive tracer detection method. At higher iodide concentrations spectrophotometry was used. The effect of gamma-radiation in the presence of hydrogen was also investigated. Effect of I^- concentration was also studied.

8784 (CEA-CONF—9029) New electricity of France PWR: calculation scheme of neutron leakages from the reactor cavity. Vergnaud, T.; Bourdet, L.; Nimal, J.C.; Brandicourt, G.; Champion, G. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Dept. d'Etudes Mecaniques et Thermiques). Apr 1987. 13p. (CONF-870405—). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88750654/JAW.

From Topical conference on theory and practice in radiation protection and shielding; Knoxville, TN, USA (22 Apr 1987).

A new calculation scheme is adapted to evaluate neutron fluxes in the reactor cavity and the containment of next french PWR. In this scheme a large part is given to Monte Carlo method, coupled with SN-method, in order to take into account multiple neutron diffusions and the complexity of the reactor geometry.

8785 (CEA-CONF—9031) APOLLO II: an user-oriented, portable, modular code for multigroup transport assembly calculations. Sanchez, R.; Stankovsky, Z.; Cossic, A.; Mondot, J.; Zmijarevic, I. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Dept. d'Etudes Mecaniques et Thermiques). Apr 1987. 16p. (CONF-870424—). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88750652/JAW.

From American Nuclear Society international meeting on advances in reactor physics, mathematics and computation; Paris, France (27 Apr 1987).

APOLLO II is a new, multigroup transport code under development at the Commissariat a l'Energie Atomique. The code has a modular structure and uses sophisticated software for data structuralization, dynamic memory management, data storage and user's macrolanguage. This paper gives an overview of the main methods used in the code for a) multidimensional collision-probability calculations, b) leakage calculations and c) homogenization procedures. Numerical examples are shown to demonstrate the potentialities of the modular structure of the code and the interest of the novel multilevel flat-flux representation used in the calculation of the collision probabilities.

8786 **(CEGB-TPRD/B—0745/R86) Model for PWR pressure vessel embrittlement.** Fisher, S.B.; Buswell, J.T. (Central Electricity Generating Board, Berkeley (UK). Berkeley Nuclear Labs.). Jan 1986. 70p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE88750725/JAW.

A model has recently been described for the interpretation of yield stress monitoring data from surveillance samples of pressure vessel steels exposed in Magnox reactors. The model assumes embrittlement to arise from the combined effects of damage clusters and copper precipitates. The formation of the precipitates may be enhanced by irradiation. In this report, the Magnox model is extended and adapted to enable an interpretation of data from PWR pressure vessel steels to be made. The model is then used to estimate the changes in properties that will occur throughout the pressure vessel wall in the beltline region of the proposed UK PWR. It is found that the model successfully accounts for the trends of PWR surveillance and MTR embrittlement data with exposure and copper content. (U.K.).

8787 **(CONF-871101—70) Comparative performance of the conjugate gradient and SOR [Successive Over Relaxation] methods for computational thermal hydraulics.** King, J.B.; Anghaie, S.; Domanus, H.M. (Oregon State Univ., Corvallis (USA); Florida Univ., Gainesville (USA); Argonne National Lab., IL (USA)). 1987. Contract W-31109-ENG-38. 8p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88002553/JAW.

From Joint meeting of the American Nuclear Society and the Atomic Industrial Forum; Los Angeles, CA, USA (15 Nov 1987).

Finite difference approximations to the continuity, momentum, and energy equations in thermal hydraulics codes result in a system of N by N equations for a problem having N field points. In a three dimensional problem, N increases as the problem becomes larger or more complex, and more rapidly as the computational mesh size is reduced. As a consequence, the execution time required to solve the problem increases, which may lead to placing limits on the problem resolution or accuracy. A conventinal method of solution of these systems of equations is the Successive Over Relaxation (SOR) technique. However, for a wide range of problems the execution time may be reduced by using a more efficient linear equation solver. One such method is the conjugate gradient method which was implemented in COMMIX-1B thermal hydraulics code. It was found that the execution time required to solve the resulting system of equations was reduced by a factor of about 2 for some problems. This paper summarizes the characteristics of these iterative solution procedures and compares their performance in modeling of a variety of reactor thermal hydraulic problems, using the COMMIX-1B computer code.

8788 **(DOE/ET/34013—13) The evaluation and demonstration of methods for improved nuclear fuel utilization: Tenth progress report, July 1, 1985-December 31, 1986.** Smith, G.P. (Combustion Engineering, Inc., Windsor, CT (USA); Arkansas Power and Light Co., Little Rock (USA)). Aug 1987. Contract AC02-79ET34013. 29p. (CEND—429). NTIS (US Sales Only), PC A03/MF A01; 1; GPO Dep. Order Number DE88003445/JAW.

The objective of this Department of Energy sponsored project is to demonstrate the extended burnup capability for Combustion Engineering 16 x 16 fuel. A demonstration of this is in progress at the Arkansas Nuclear One Unit 2 (ANO-2) reactor located near Russellville, Arkansas. This reactor is a 2815 MWt pressurized water reactor (PWR) owned and operated by Arkansas Power and Light. It is the first Combustion Engineering reactor to utilize the 16 x 16 fuel design. The extended burnup objective will be realized by demonstrating that the current fuel design is capable of increasing batch average exposure at discharge to 52 GWd/MtU and by evaluating advanced fuel designs with the potential to offer increased performance margins over the current design at similar discharge exposures. Analyses are included to assure that the extended burnup objective can be realized with conventional and low leakage fuel management schemes. During this period, test Assembly D040, which contains standard fuel rods and rods with advanced fuel designs, was visually and dimensionally examined during the EOC-5 refueling outage of ANO-2. The assembly was then reinserted into Reactor Cycle 6 for a 5th exposure cycle. 12 refs., 8 figs., 1 tab.

8789 **(EPRI-NP—5367) Filtration improvement study at Three Mile Island Unit 2: Final report.** Vance, J.N. (Vance and Associates, Ruidoso, NM (USA)). Oct 1987. 106p. Research Reports Center, Palo Alto, CA 94303. Order Number TI88920062/JAW.

This report describes the work performed to investigate filtration improvement techniques applied to an existing filtration system installed at TMI-2 to maintain water clarity for on-going defueling activities on the damaged reactor. The investigation included laboratory and full-scale testing of organic and inorganic coagulant aids and of various precoat and body feed materials singly or in combination with coagulant aids. 33 figs., 21 tabs.

8790 **(EPRI-NP—5498) Proceedings: 1983 workshop on primary-side stress corrosion cracking of PWR steam generator tubing.** Stein, A.A.; McIlree, A.R. (ed.). (Stone and Webster Engineering Corp., Boston, MA (USA)). Nov 1987. 456p. (CONF-8311309—). Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88920090/JAW.

From Workshop on primary-side stress corrosion cracking of PWR steam generator tubing; Clearwater, FL, USA (28 Nov 1983).

The workshop was held to collect current data on the experience with primary water stress corrosion cracking (PWSCC) of steam generator tubing and the related laboratory investigations. Thirty-two presentations were given covering field experience, correlations of laboratory data on the field, and relationship of material microstructure, stress, and environment to PWSCC. The emphasis of the workshop was more on the fundamentals associated with PWSCC yet culminated with several presentations on remedial measures.

8791 (INIS-mf—11048, pp 183) **Radiation protection evaluation of WWER-440 reactors for a ten years period.** Eshkenazi, R.; Stoilova, S.; Keslev, D. (Meditsinska Akademiya, Sofia, Bulgaria. Nauchen Inst. po Rentgenologiya i Radiobiologiya). Oct 1985. (In Bulgarian). NTIS (US Sales Only), PC A09/MF A01. Order Number DE88780035/JAW. (CONF-8510479—).

From 6. national congress of roentgenology, radiology and radiobiology; Sofia, Bulgaria (4 Oct 1985).

8792 (IWGFPT—27, pp 19-43) **PWR fuel element behavior at temperatures up to 2350°C.** Hagen, S.; Hofmann, P. (Kernforschungszentrum Karlsruhe, GmbH, Federal Republic of Germany). 1987. NTIS (US Sales Only), PC A12/MF A01. Order Number DE88900151/JAW. (CONF-8611109—).

From IAEA technical committee meeting on water reactor fuel behaviour and fission products release in off-normal and accident conditions; Vienna, Austria (10 Nov 1986).

Chemical interactions between UO_2 fuel and Zircaloy cladding up to 2350°C is described. UO_2/Zircaloy single effects tests have been performed with short LWR fuel rod segments in inert gas and under oxidizing conditions. The reaction kinetics of molten Zircaloy cladding with solid UO_2 fuel has been investigated with UO_2 crucibles containing molten Zircaloy. The UO_2/Zircaloy reactions obey parabolic rate laws. The oxygen uptake by solid Zircaloy due to chemical interaction with UO_2 occurs nearly as quickly as in reactions with steam or oxygen. To study the competing effects of external and internal cladding oxidation under realistic boundary conditions and the influence of uncontrolled temperature escalation due to the exothermic steam/Zircaloy reaction, single-rod and bundle experiments have been performed. Electrically heated fuel rod simulators, including absorber rod material (Ag, In, Cd alloy), guide tubes and grid spacers are used. The maximum measured cladding temperature during the temperature escalation was about 2200°C. The failure temperature of the absorber rods and the extent of bundle damage depends on the guide tube material (Zircaloy or stainless steel) and varies between 1200 and 1350°C. The molten materials and liquid reaction products can relocate and

form large coherent lumps on solidification, which may result in complete blockage of the fuel rod bundle cross section.

8793 (NUREG/CR—4985) Indian Point 2 Reactor Coolant Pump Seal evaluations. Subudhi, M.; Taylor, J.H.; Clinton, J.H.; Czajkowski, C.J.; Weeks, J.R. (Brookhaven National Lab., Upton, NY (USA)). Aug 1987. Contract AC02-76CH00016. 98p. (BNL-NUREG—52095). NTIS, PC A05/MF A01 - GPO. Order Number TI88002753/JAW.

This report summarizes the findings on Westinghouse Reactor Coolant Pump Seal Performance at the Indian Point 2 Nuclear Power Station. The study was conducted under the joint sponsorship of Consolidated Edison of New York and the US Nuclear Regulatory Commission Office of Research. The conclusions and recommendations herein are based on the review of the plant operational and maintenance data on seals, consultation with Westinghouse and Utilities, review of prior studies, and visual as well as in-depth examination of service exposed seals received from the plant. 9 refs., 28 figs., 3 tabs.

8794 (RISO-M—2640) Simulation model of a PWR power plant. Larsen, N. (Risoe National Lab., Roskilde (Denmark)). Mar 1987. 109p. NTIS (US Sales Only), PC A06/MF A01. Order Number DE88751478/JAW.

A simulation model of a hypothetical PWR power plant is described. A large number of disturbances and failures in plant function can be simulated. The model is written as seven modules to the modular simulation system for continuous processes DYSIM and serves also as a user example of this system. The model runs in Fortran 77 on the IBM-PC-AT.

8795 Indicated and actual mass inventory measurements for an inverted U-tube steam generator. Loomis, G.G.; Plessinger, M.P.; Boucher, T.J. New York, NY; American Society of Mechanical Engineers (1987). 7p. (CONF-861211—). American Society of Mechanical Engineers, 345 East 47 St., New York, NY 10017.

From American Society of Mechanical Engineers winter meeting; Anaheim, CA, USA (7 Dec 1986).

Technical Paper 86-WA/NE-7.

Results from an experimental investigation of actual versus indicated secondary liquid level in a steam generator at steaming conditions are presented. The experimental investigation was performed in two different small scale U-tube-in-shell steam generators as typical pressurized water reactor operating conditions (5-7 MPa; saturated) in the Semiscale facility. During steaming conditions, the indicated secondary liquid level was found to vary considerably from the actual "bottled-up" liquid level. These differences between indicated and actual liquid level are related to the frictional pressure drop associated with the two-phase steaming condition in the riser. Data from a series of bottle-up experiments (simultaneously, the primary heat source and secondary feed and steam are terminated) are tabulated and the actual liquid level is correlated to the indicated liquid level.

8796 Steady-state heat transfer in an inverted U-tube steam generator. Boucher, T.J. New York, NY; American Society of Mechanical Engineers (1987). 6p. (CONF-861211—). American Society of Mechanical Engineers, 345 East 47 St., New York, NY 10017.

From American Society of Mechanical Engineers winter meeting; Anaheim, CA, USA (7 Dec 1986).

Technical Paper 86-WA/NE-6.

Experimental results are presented involving U-tube steam generator tube bundle local heat transfer and fluid conditions during stead-state, full-power operations performed at high temperatures and pressures with conditions typical of a pressurized water reactor (15.0 MPa primary pressure, 600 K steam generator inlet plenum fluid temperatures, 6.2 MPa secondary pressure). The Semiscale (MOD-2C facility represents the state-of-the-art in measurement of tube local heat transfer data and average tube bundle secondary fluid density at several elevations, which allows an estimate of the axial heat transfer and void distributions during steady-state and transient operations. The method of heat transfer data reduction is presented and the heat flux, secondary convective heat transfer coefficient, and void fraction distributions are quantified for steady-state, full-power operations.

8797 Application of detailed fission-product decay gamma spectra in the calculation of photoneutron spectra from D(γ,n) reactions in PWR fuel. Wilson, W.B.; Stewart, J.E.; England, T.R.; Perry, R.T. (Los Alamos National Lab., NM, USA; Texas A and M Univ., College Station, USA). *Radiation Effects;* **93**: No. 1-4, 209-212(1986). (CONF-850507—).

From International conference on nuclear data for basic and applied science; Santa Fe, NM, USA (13 May 1985).

The magnitude, average neutron energy, and spectrum of the photoneutron source in a PWR fuel is calculated for shutdown times to 100 y using CINDER radionuclide inventory calculations, ENDF/B-V γ line decay spectra, MCNP γ transport calculations, and PHONEX D(γ,n) reaction physics calculations.

8798 Combining integral and differential dosimetry data in an unfolding procedure with application to the Arkansas nuclear one-unit 1 reactor. Maerker, R.; Broadhead, B.; Chia-Yao Fu; Wagschal, J.; Williams, J.; Williams, M. (Oak Ridge National Lab., TN, USA; Hebrew Univ., Jerusalem, Israel; Arkansas Univ., Fayetteville, USA; Louisiana State Univ., Baton Rouge, USA). *Radiation Effects;* **93**: No. 1-4, 141-145(1986). (CONF-850507—).

From International conference on nuclear data for basic and applied science; Santa Fe, NM, USA (13 May 1985).

The LEPRICON adjustment procedure involves combining both differential and integral data, including covariances and sensitivities, in such a way that calculated spectral fluences at important locations within a pressure vessel of an operating PWR can be adjusted with significantly reduced uncertainties. The procedure allows simultaneous combination of integral dosimetry measurements performed at a reactor surveillance location with measurements performed in geometrically simpler benchmark facilities. An application of this technique is given to an existing PWR, and the results consistently indicate a need for significant (approx. 8%) adjustments in the total inelastic cross section of iron in the region between 3 and 8 MeV using cross sections and covariances from ENDF/B-V. Dosimetry cross sections were taken mainly from a revised version of ENDF/B-V and were found to require relatively small adjustments. Covariances of the spectral fluences are reduced by factors lying between two and four.

8799 Investigation of corrosion and stress corrosion cracking in bolting materials on light water reactors. Czajkowski, C.J. (Brookhaven National Lab., Upton, NY, USA). *International Journal of Pressure Vessels and Piping;* **26**: No. 2, 87-96(1986).

Laboratory experiments performed at Brookhaven National Laboratory have shown that the concentration of boric acid to a moist paste at approximately the boiling point of water can produce corrosion rates of the order of approximately 3.5mm per year on bolting and piping materials, which values are consistent with service experience. Other failure evaluation experience has shown that primary coolant-lubricant interaction may lead to stress corrosion cracking (SCC) of steam generator manway studs. An investigation was also performed on eleven lubricants and their effects on A193 B7 and A540 B24 bolting materials. H_2S generation by the lubricants, coefficient of friction results and transgranular SCC of the bolting materials in steam are discussed.

2103 Power Reactors, Non-breeding, Graphite

Moderated

REFER ALSO TO CITATION(S) 8557, 8917, 8918, 8919, 8926, 8928, 8937, 8947, 9165

2104 Power Reactors, Non-breeding, Otherwise Moderated Or Unmoderated

REFER ALSO TO CITATION(S) 8903, 8918, 8921, 8926

2105 Power Reactors, Breeding

REFER ALSO TO CITATION(S) 8787, 8869, 8879, 8882, 8885, 8886, 8908, 8941, 8943

8800 **(AEEW-R—2028) Measurement and analysis of reaction rates in simulated PFR demountable subassembly heat-pins in ZEBRA.** Burbidge, B.L.H.; Osmond, A.M.; Stevenson, J.M. (UKAEA Atomic Energy Establishment, Winfrith). Dec 1985. 59p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE88750722/JAW.

Measurements completed on the Zebra reactor to assess the reliability of current diffusion-theory predictions of the power generated in DMSA heater pins in PFR, are described. A range of heater pin configurations was simulated, and reaction rates of fission in Pu 239, U 238 and U 235 and capture in U 238 were measured. These were also calculated using standard Zebra methods. The calculated-to-experimental ratios were in the range 1.03 to 1.05, giving confidence in the methods of prediction used for PFR. (U.K.).

8801 **(CEA-CONF—9036) Streaming effects in inter-assembly gaps of fast reactors.** Benoist, P.; Salvatores, M. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Dept. d'Etudes Mecaniques et Thermiques). Apr 1987. 12p. (CONF-870424—). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88750653/JAW.

From American Nuclear Society international meeting on advances in reactor physics, mathematics and computation; Paris, France (27 Apr 1987).

In a power LMFBR, the hexagonal assemblies are separated by sodium gaps. Due to the relatively high mean free path of sodium, these gaps introduce a streaming effect which increases the absolute value of the leakage component of the reactivity, compared to the case where sodium is simply smeared with the assembly material. This effect is enhanced in accidental situations where sodium is voided. A theoretical method, based on a reasonable approximation, is proposed for the calculation of these effects. Numerical values of the reactivity changes are given and show that the streaming effects are important. Values of the reactivity change are also given for another accidental case, in which the core is compacted is such a way that the gaps disappear. Some critical facilities contain a 2D array of perpendicular void gaps. A particular method for the calculation of the streaming in such a lattice is proposed, and numerical values are given. This is important for assessing bias factors in the interpretation of integral experiments.

8802 **(CLM-R—262) CURLIM-a rate limited MCFI model for sodium. Part 1: fundamental model and parameter studies.** Fletcher, D.F. (UKAEA Culham Lab., Abingdon). Dec 1985. 43p. (RS—85-N32). H.M. Stationery Office, London, price Pound 5.00.

This paper describes the first stage in the development of a rate limited MFCI (Motten Fuel Coolant Interaction) model for sodium. The model assumes one dimensional geometry with an interaction zone surmounted by a sodium slug which compresses a fixed mass of overgas as it moves. It allows for compressibility effects in the initial response of the slug but changes to an inertial load when these become unimportant. The overall heat transfer from fuel to coolant in the interaction zone is modelled by separate treatments of fuel fragmentation and heat transfer per unit area. Fuel fragmentation is modelled by allowing the melt surface area to increase linearly over a user-specified time; heat transfer per unit area is modelled using specified heat transfer coefficients. The model will be modified to include a mechanistic treatment of heat transfer and fragmentation. The model has been applied to examine the effect of the heat transfer, hydrodynamic, and cover gas parameters. The first results have highlighted the importance of modelling a rapid heat transfer stage correctly. In particular they have shown the importance of knowing whether a metal-insulator transition occurs in sodium, and if so for what thermodynamic conditions it occurs.

8803 **(CONF-871234—3) COMMIX analysis of the sodium heated helical coil steam generator.** Kakarala, C.R.; Burge, S.W.; Sha, W.T. (Babcock and Wilcox Co., Barberton, OH (USA); Babcock and Wilcox Co., Alliance, OH (USA); Argonne National Lab., IL (USA)). 1987. Contract W-31109-ENG-38. 40p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88002898/JAW.

From ASME winter meeting; Boston, MA, USA (13 Dec 1987).

This paper describes the COMMIX-HCSG computer program and compares predictions to data obtained from performance tests on a 76 MWt Helical Coil Steam Generator (HCSG) test unit. COMMIX-HCSG is a multi-dimensional thermal/hydraulic code that models both steady state and transient operation of an HCSG. The code solves a system of Navier-Stokes continuum equations that have been modified with a combination of volume and directional surface porosities and distributed resistances. This formulation properly accounts for the presence of tube bundle, supports, and baffles on the shell side of the steam generator. Turbulence models and heat transfer and pressure drop equations are used as applicable for the different regions including the upper plenum, the tube bundle, and the lower plenum of the HCSG. The data was obtained from performance tests conducted in early 1987 on the 76 MWt HCSG test unit at the Energy Technology Engineering Center (ETEC). The test unit contains over 700 instruments. HCSG development and tests are carried out as part of the Department of Energy program to develop reliable and economical liquid metal heated steam generators.

8804 **(CONF-8709192—2) A simplified model of core thermal dilation.** Moran, T.J. (Argonne National Lab., IL (USA)). 1987. Contract W-31109-ENG-38. 9p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88002972/JAW.

From Annual NEACRP meeting; Helsinki, Finland (14 Sep 1987).

A simple analytical model is developed of core radial expansion for a fast reactor using a limited-free-bow core restraint design. The model is restricted to those bowing regimes where the plane of above core load pads (ACLP) is compacted to the point where the outermost driver assemblies are restrained at the ACLP from further compaction by a continuous network of contacting load pads, and where the top load pads (TLP) of the outer driver assemblies are restrained from further radial expansion by continuous load paths to the TLP restraint ring. Essentially elementary beam theory is used to calculate the elastic bow of a driver assembly at the core periphery subject to temperature dependent boundary conditions at the nozzle support, ACLP and TLP and subject to thermal and inelastic bowing deformations. The following design parameters are considered: grid plate temperature, core temperature rise, restraint ring temperature, grid plate and restraint ring thermal expansion coefficients, duct material properties (thermal expansion, swelling and creep), nozzle support condition, core radius, core axial location, core height, driver assembly radial thermal gradient, ACLP location and compressibility, and gaps at the ACLP and TLP elevations.

8805 **(CONF-8709193—1) Experience with lifetime limits for EBR-II core components.** Lambert, J.D.B.; Smith, R.N.; Golden, G.H. (Argonne National Lab., IL (USA)). 1987. Contract W-31109-ENG-38. 11p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88002949/JAW.

From US/USSR specialist meeting on fast reactor core components; Richland, WA, USA (8 Sep 1987).

The Experimental Breeder Reactor No. 2 (EBR-II) is operated for the US Department of Energy by Argonne National Labo-

ratory and is located on the Idaho National Engineering Laboratory where most types of American reactor were originally tested. EBR-II is a complete electricity-producing power plant now in its twenty-fourth year of successful operation. During this long history the reactor has had several concurrent missions, such as demonstration of a closed Liquid-Metal Reactor (LMR) fuel cycle (1964-69); as a steady-state irradiation facility for fuels and materials (1970 onwards); for investigating effects of operational transients on fuel elements (from 1981); for research into the inherent safety aspects of metal-fueled LMR's (from 1983); and, most recently, for demonstration of the Integral Fast Reactor (IFR) concept using U-Pu-Zr fuels. This paper describes experience gained at EBR-II in defining lifetime limits for LMR core components, particularly fuel elements.

8806 **(INIS-mf—10773) Thermal breeding with spallation neutron induced core.** Suender, B. (Technische Hochschule Aachen (Germany, F.R.). Fakultaet fuer Maschinenwesen). 2 Jul 1984. 80p. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88751504/JAW.

It is possible to reduce dependence on uranium supplies by the spallation technique. This technique will only become economically sensible if uranium prices rise considerably, as the capital service share of the electricity costs reaches a value of 80% in spallation reactors. One can obtain a compensated fuel balance by the spallation processes, but the acceleration efficiencies of less than 50% achieved up to now are not sufficient.

8807 **(INIS-mf—10775) Recycling of the actinides neptunium, americium and curium in a fast power reactor to reduce the long term activity in a final store.** Beims, H.D. (Technische Hochschule Aachen (Germany, F.R.). Fakultaet fuer Elektrotechnik). 10 Jan 1986. 152p. (In German). NTIS (US Sales Only), PC A08/MF A01. Order Number DE88751506/JAW.

The starting point for the considerations and calculations given in this dissertation is the inevitable production of radioactive materials in the use of nuclear energy, which creates a considerable potential danger in a final store for a very long period. As one possibility of alleviating this problem, a concept for recycling the waste actinides neptunium, americium and curium was proposed. The waste actinides are separated in the reprocessing of burnt-up fuel elements and reach a further irradiation circuit. There they pass through the stages 'manufacture of irradiation elements', 'use in a fast power reactor' and reprocessing of irradiation elements' several times. In each irradiation and subsequent storage, about 17% of the waste actinides are removed by fission or by conversion into nuclides which can be reused as fuel, so that during the life of 40 years of the fast recycling reacor, the waste actinides can be reduced in mass by one half. In order to determine this mass reduction effect, a model calculation was developed, which includes the representation of the neutron physics and thermal properties of the reactor core and the storage and reprocessing of the irradiation elements.

8808 **(IWGFR—59) Specialists' meeting on LMFBR fuel rod behaviour under operational transients, Kalpakkam, India, 3-6 December 1985.** (International Atomic Energy Agency, Vienna (Austria). International Working Group on Fast Reactors; Indira Gandhi Centre for Atomic Research, Kalpakkam (India)). Dec 1985. 228p. (CONF-8512144—). NTIS (US Sales Only), PC A11/MF A01. Order Number DE88700776/JAW.

From IWGFR specialists' meeting on LMFBR fuel rod behaviour under operational transients; Kalpakkam, India (3 Dec 1985).

IWGFR Specialists' Meeting on "LMFBR Fuel Rod Behaviour Under Operational Transients" was held in Indira Gandhi Centre for Atomic Research (IGCAR), Kalpakkam during 3-6 December 1985. The meeting was attended by the representatives of Belgium, France, FRG, India, Italy, US, USSR, IAEA and observers from India. The purpose of the meeting was to provide a forum for the exchange of information on the subject of LMFBR Fuel Rod Behaviour Under Operational Transients. The meeting presentations were divided into sessions devoted to the following topics: Overview of National Programmes (3 papers); In-pile and out-pile experimental facilities and results (5 papers); Modelling and Code work (5 papers). A separate abstract was prepared for each of these papers.

8809 (IWGFR—59, pp 25-46) **DeBeNe program to investigate LMFBR fuel pin behaviour under transient loadings.** Plitz, H. (Kernforschungszentrum Karlsruhe G.m.b.H., Germany, F.R. Projekt Schneller Brueter). Dec 1985. NTIS (US Sales Only), PC A11/MF A01. Order Number DE88700776/JAW. (CONF-8512144—).

From IWGFR specialists' meeting on LMFBR fuel rod behaviour under operational transients; Kalpakkam, India (3 Dec 1985).

During LMFBR plant operation deviations from steady state power generation may occur for reasons like heavy duty cycling, power ramping, overpower terminated by scram level actuation and minor coolant flow disturbances causing clad temperature raise. Those transients can lead to fuel element lifetime shortening or fuel pin failures. Since for availability reasons LMFBR plants should stand all kinds of transients to certain levels, adequate programs to demonstrate and assess fuel pin performance during and post transient conditions are required. 6 refs, 14 figs.

8810 (IWGFR—59, pp 47-52) **Survey on the Italian programme on FBR fuel rod behaviour under transients.** Cecchi, P. (ENEA, VEL/PRO, Bologna, Italy). Dec 1985. NTIS (US Sales Only), PC A11/MF A01. Order Number DE88700776/JAW. (CONF-8512144—).

From IWGFR specialists' meeting on LMFBR fuel rod behaviour under operational transients; Kalpakkam, India (3 Dec 1985).

The main activities carried out by the Fast Reactor Department to accomplish the design of the PEC reactor and R and D activities for FBRs performed in the framework of an European collaboration agreement are described in this paper. 2 figs, 1 tab.

8811 (IWGFR—59, pp 53-60) **Categories of operational transient in French LMFBR plants.** Languille, A. Dec 1985. NTIS (US Sales Only), PC A11/MF A01. Order Number DE88700776/JAW. (CONF-8512144—).

From IWGFR specialists' meeting on LMFBR fuel rod behaviour under operational transients; Kalpakkam, India (3 Dec 1985).

An overall view on safety approach for future LMFBR in FRANCE is done with some specific highlights on operational transients. 1 fig, 1 tab.

8812 (IWGFR—59, pp 62-68) **Experimental program on fuel rod behaviour under off-normal conditions.** Languille, A.; Cecchi, P. (CEA Centre d'Etudes Nucleaires de Cadarache, 13 - Saint-Paul-lez-Durance, France; ENEA, Bologna, Italy). Dec 1985. NTIS (US Sales Only), PC A11/MF A01. Order Number DE88700776/JAW. (CONF-8512144—).

From IWGFR specialists' meeting on LMFBR fuel rod behaviour under operational transients; Kalpakkam, India (3 Dec 1985).

During LMFBR plant operation, fuel developments are primarily concerned with the fuel pin irradiation behaviour under steady-state conditions up to high burn-up levels. But additional studies under off-normal conditions are necessary in order to assess fuel pin performance and to define operational limits. 1 tab.

8813 (IWGFR—59, pp 69-81) **Study of the BOR-60 fuel subassemblies behaviour under various operating conditions.** Efimov, V.N.; Gadzhiev, G.I.; Mayershin, A.A.; Polyakov, V.I.; Starozhukov, D.I. (Nauchno-Issledovatel'skij Inst. Atomnykh Reaktorov, Dimitrovgrad, USSR). Dec 1985. NTIS (US Sales Only), PC A11/MF A01. Order Number DE88700776/JAW. (CONF-8512144—).

From IWGFR specialists' meeting on LMFBR fuel rod behaviour under operational transients; Kalpakkam, India (3 Dec 1985).

The characteristics of the BOR-60 reactor transient and emergency conditions have been considered. Both the deviation and the rates of changes in the fuel pin temperatures have been de-

termined by means of the calculational and experimental studies. The measurements of reactivities associated with the fuel structure formation and swelling have been interpreted. The effect of severe transients on the fuel pin clad integrity has been demonstrated. The main results from the analysis of the experimental vibropack fuel pin performance are presented. 6 refs, 5 figs, 1 tab.

8814 (IWGFR—59, pp 83-129) **Transients and safety testing of LMFBR fuel pins in the reactor BR2.** Dekeyser, J. (Centre d'Etude de l'Energie Nucleaire, Mol, Belgium). Dec 1985. NTIS (US Sales Only), PC A11/MF A01. Order Number DE88700776/JAW. (CONF-8512144—).

From IWGFR specialists' meeting on LMFBR fuel rod behaviour under operational transients; Kalpakkam, India (3 Dec 1985).

Testing of the behaviour of LMFBR fuel pins under operational transients has been performed in the reactor BR2 at S.C.K./C.E.N.-Mol (Belgium) since 1981 in the framework of the DEBENE programme "SNR-Betriebstransienten-experimente". A special purpose sodium loop, called "VIC", has therefore been developed to allow off-nominal and transient experiments on single fuel pins under realistic fast reactor operating conditions. Two basic types of tests can be run, either separately or simultaneously: fission power alteration, e.g. steady overpower runs, power cycling and fast transient overpower (TOP); mismatch of the sodium cooling, e.g. operation with reduced sodium flow and transient loss of flow (LOF). The loop allows the loading and testing of pre-irradiated fuel pins. In the field of safety oriented tests, the programme "MOL 7 C" investigates the LMFBR fuel element behaviour under locally blocked cooling conditions and the possible failure propagation. The work is jointly carried out by the Karlsruhe center KfK (FRG) and S.C.K./C.E.N.-Mol (Belgium). The related in-pile tests in the reactor BR2 have started in 1977 and are performed in a fully integrated sodium loop. The test section contains a 30-rod bundle with fresh or pre-irradiated fuel pins. A local porous blockage within the fuel bundle initiates severe local damage to the central rods. Important informations are obtained with respect to the problems of pin to pin propagation and the long term behaviour of a fuel subassembly with defect pins. The MOL 7 C loop system can also be used to run operational transients on a fuel bundle with representative fuel pins. The paper describes the irradiation devices VIC and MOL 7 C from their technological point of view and depicts their field of testing applications. Also the major experiments already performed and relevant irradiation data are reviewed. 12 refs, 19 figs, 5 tabs.

8815 (IWGFR—59, pp 131-136) **LMFBR. Off normal, transient test facilities and programs in the USA.** Herbst, R.J. (Los Alamos National Lab., NM, USA). Dec 1985. NTIS (US Sales Only), PC A11/MF A01. Order Number DE88700776/JAW. (CONF-8512144—).

From IWGFR specialists' meeting on LMFBR fuel rod behaviour under operational transients; Kalpakkam, India (3 Dec 1985).

The United States fast breeder reactor development program has included operational transient analyses and experiments to verify the predicted performance of core components. Operational transient testing has focused on off-normal operation during Plant Protection System terminated transient-overpower events. In-pile and out-of-pile tests have been used to simulate predicted thermal and mechanical strain cycles and measure component response. The spectrum of reactivity ramp rates investigated in TOP tests has recently been expanded to include rates of less than $0.1/s. These slow ramp rate studies are being done in cooperation with the Japanese. The US has also cooperated with the UK in the transient testing of Prototype Fast Reactor fuel pins. 1 fig, 1 tab.

8816 (IWGFR—59, pp 137-143) **Fuel cladding mechanical interaction during power ramps.** Guerin, Y. (CEA Centre d'Etudes Nucleaires de Cadarache, 13 - Saint-Paul-lez-Durance, France. Inst. de Recherche Technologique et de Developpement Industriel, IRDI). Dec 1985. NTIS (US Sales Only), PC A11/MF A01. Order Number DE88700776/JAW. (CONF-8512144—).

From IWGFR specialists' meeting on LMFBR fuel rod behaviour under operational transients; Kalpakkam, India (3 Dec 1985).

Mechanical interaction between fuel and cladding may occur as a consequence of two types of phenomenon: i) fuel swelling especially at levels of caesium accumulation, and ii) thermal differential expansion during power changes. Slow overpower ramps which may occur during incidental events are of course one of the circumstances responsible for this second type of fuel cladding mechanical interaction (FCMI). Experiments and analysis of this problem that have been done at C.E.A. allow to determine the main parameters which will fix the level of stress and the risk of damage induced by the fuel in the cladding during overpower transients. 1 ref, 1 fig.

8817 (IWGFR—59, pp 145-154) **Molten fuel behaviour during slow overpower transients.** Guerin, Y.; Boidron, M. (CEA Centre d'Etudes Nucleaires de Cadarache, 13 - Saint-Paul-lez-Durance, France. Inst. de Recherche Technologique et de Developpement Industriel, IRDI). Dec 1985. NTIS (US Sales Only), PC A11/MF A01. Order Number DE88700776/JAW. (CONF-8512144—).

From IWGFR specialists' meeting on LMFBR fuel rod behaviour under operational transients; Kalpakkam, India (3 Dec 1985).

In large commercial reactors as Super-Phenix, if we take into account all the uncertainties on the pins and on the core, it is no longer possible to guarantee the absence of fuel melting during incidental events such as slow overpower transients. We have then to explain what happens in the pins when fuel melting occurs and to demonstrate that a limited amount of molten fuel generates no risk of clad failure. For that purpose, we may use the results of a great number of experiments (about 40) that have been performed at C.E.A., most of them in thermal reactor, but some experiments have also been performed in Rapsodie, especially during the last run of this reactor. In a great part of these experiments, fuel melting occurred at beginning of life, but we have also some results at different burnups up to 5 at %. It is not the aim of this paper to describe all these experiments and the results of their post irradiation examination, but to summarize the main conclusions that have been set out of them and that have enabled us to determine the main characteristics of fuel element behaviour when fuel melting occurs. 2 refs, 2 figs.

8818 (IWGFR—59, pp 155-166) **Analysis of fast reactor fuel behaviour in transients.** Bibilashvili, Yu.K.; Bogatyr, S.M.; Golovnin, I.S.; Medvedev, A.V. (Vsesoyuznyj Nauchno-Issledovatel'skij Inst. Neorganicheskikh Materialov, Moscow, USSR). Dec 1985. NTIS (US Sales Only), PC A11/MF A01. Order Number DE88700776/JAW. (CONF-8512144—).

From IWGFR specialists' meeting on LMFBR fuel rod behaviour under operational transients; Kalpakkam, India (3 Dec 1985).

During operation of nuclear power plants with fast reactors transients are not excluded that are due to planned start-up and shut-down, safety system trips etc. The major factor that determines the fuel behaviour under the indicated conditions is a thermomechanical PCI. The paper gives the results of design studies of the influence of some parameters of transients, condition of a cladding material and fuel on fuel rod serviceability. 2 refs, 6 figs.

8819 (IWGFR—59, pp 167-176) **FACTT - A computer code for calculation of fuel and clad temperatures under transient conditions.** Govindarajan, S.; Vaidyanathan, G. (Reactor Research Centre, Kalpakkam, India). Dec 1985. NTIS (US Sales Only), PC A11/MF A01. Order Number DE88700776/JAW. (CONF-8512144—).

From IWGFR specialists' meeting on LMFBR fuel rod behaviour under operational transients; Kalpakkam, India (3 Dec 1985).

The starting point in the analysis of fuel behaviour under operational transients is calculation of fuel and clad temperatures. In a sophisticated code meant to evaluate various aspects of fuel behaviour, it is desirable to have a fast and accurate method to calculate temperatures. Towards this goal, a computer code FACTT has been developed for the calculation of temperatures under operational transients. A brief description of the method adopted in the code and the capabilities of the code is given in this paper. 1 ref, 4 figs.

8820 (IWGFR—59, pp 177-189) **Influence of fast reactor emergency conditions upon fuel element performance.** Bagdasarov, Yu.E.; Buksha, Yu.K.; Zabudko, L.M.; Likhachev, Yu.I. Dec 1985. NTIS (US Sales Only), PC A11/MF A01. Order Number DE88700776/JAW. (CONF-8512144—).

From IWGFR specialists' meeting on LMFBR fuel rod behaviour under operational transients; Kalpakkam, India (3 Dec 1985).

Fuel-pin cladding is one of the most important protective barriers preventing the release and propagation of radioactive contamination. By now the calculated determination of fast-reactor fuel-element performance under stationary conditions has been considered in detail but the investigation of the influence of emergency conditions has been given less attention. Under emergency conditions of the fast reactor operation there arise short-duration excesses of rated parameters (temperature, energy release, etc.) which are confined within tolerable limits with the use of the safety system. Some features of the sodium-cooled fast reactors (small mean prompt-neutron lifetime, relatively weak reactivity feedback, etc.) complicate the work of safety systems. Therefore, the tolerable deviations of parameters should be carefully validated. 4 refs, 4 figs, 1 tab.

8821 (IWGFR—59, pp 191-204) **Transient fission gas release during fast reactor transients.** Vliet, J. van. (Societe Belge pour l'Industrie Nucleaire, Brussels). Dec 1985. NTIS (US Sales Only), PC A11/MF A01. Order Number DE88700776/JAW. (CONF-8512144—).

From IWGFR specialists' meeting on LMFBR fuel rod behaviour under operational transients; Kalpakkam, India (3 Dec 1985).

This paper presents modelling work performed at BELGONUCLEAIRE in order to understand the processes by which fission products are released from oxide fuel during fast reactor transients, for heating rates up to 1000 K/s. After a review of available experimental data, a model based on transient equiaxed grain growth is proposed which provides a simple interpretation of observed facts, including gas release, denuded zones and fuel swelling. Application of this model shows that fission gas release is quite important in case of solid fuel, and stresses the impact of fuel burnup and stoichiometry on the fission gas release and swelling phenmomena. 16 refs, 5 figs.

8822 **(KFK—4310) IVA2 verification: Expansion phase experiment in SNR geometry.** Kolev, N.I. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Neutronenphysik und Reaktortechnik). Sep 1987. 21p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88751531/JAW.

Using the IVA2/005 computer code the SNR model explosion experiment SGI-09-1 was numerically simulated. The experiment consists of high pressure gas injection into a low pressure liquid pool with a free surface in a cylindrical geometry with internals. Bubble formation and pressure history as a function of time was predicted and compared with the experimental observation. A good agreement between theory and experiment was obtained. Numerical diffusion and its influence on the results are discussed.

8823 **(WAPD-TM—1603) Light Water Breeder Reactor fuel element performance characteristics for extending core lifetime: (LWBR Development Program).** Smith, B.C.; Campbell, W.R. (Bettis Atomic Power Lab., West Mifflin, PA (USA)). Oct 1987. Contract AC11-76PN00014. 109p. NTIS, PC A06/MF A01; 1; GPO Dep. Order Number DE88003448/JAW.

The Light Water Breeder Reactor (LWBR) was designed for a lifetime of 18,000 EFPH. Fuel element design was based on performance evaluations demonstrating adequacy for the design lifetime. Continued operation of LWBR beyond design lifetime required re-evaluation of fuel element behavior to determine if continued satisfactory fuel performance could be achieved. The evaluations covered the most limiting fuel performance concerns for extended lifetime: Zircaloy cladding corrosion, hydriding, flow-induced vibratory wear, cladding deformation into unsupported axial gaps, pellet-cladding interaction (PCI) during controlled and accidental power increases, rod elongation, and rod-to-rod clearance reduction due to rod bowing. Results of the evaluations are described. Based on these results, limits on reactor operating power, pressure, and temperature during extended lifetime were defined to allow LWBR to achieve over 29,000 EFPH of satisfactory operation.

8824 **Current status of fast reactor physics reactivity coefficients.** LeSage, L.G.; Lineberry, M.J.; McFarlane, H.F. (Argonne National Lab., IL, USA; Argonne National Lab., Idaho Falls, ID, USA). *Progress in Nuclear Energy;* **16**: No. 3, 231-250(1985).

The role of reactivity coefficients in fast reactors on design, the operational regime and safety analysis are reviewed. The basic elements of reactivity coefficient calculations are discussed. Variation of key safety coefficients with design alternatives are outlined, and a comparison of measured and calculated reactivity coefficients is made. (U.K.).

2107 Regulation And Licensing

REFER ALSO TO CITATION(S) 8674, 8929, 8930, 8931

8825 **(NUREG—0386-Digest.4-Rev.6) United States Nuclear Regulatory Commission Staff Practice and Procedure Digest: Commission, Appeal Board and Licensing Board decisions, July 1972-December 1986.** (Nuclear Regulatory Commission, Washington, DC (USA). Office of the General Counsel). Nov 1987. 563p. NTIS, PC A24/MF A01 - GPO. Order Number TI88900173/JAW.

This Revision 6 of the fourth edition of the NRC Staff Practice and Procedure Digest contains a digest of a number of Commission, Atomic Safety and Licensing Appeal Board, and Atomic Safety and Licensing Board decisions issued during the period from July 1, 1972 to December 31, 1986, interpreting the NRC's Rules of Practice in 10 CFR Part 2. This Revision 6 replaces in part earlier editions and supplements and includes appropriate changes reflecting the amendments to the Rules of Practice effective through December 31, 1986.

8826 **(NUREG—8900186) NRC quarterly [status] report.** (Nuclear Regulatory Commission, Washington, DC (USA)). 13 Nov 1987. 12p. NTIS, PC A03/MF A01 - GPO. Order Number TI88900186/JAW.

This report covers the third quarter of calendar year 1987. The NRC licensing activity during the period of this report included the issuance of a full-power license for Beaver Valley 2 on August 14, 1987, and operating license restricted to five percent power for South Texas Unit 1 on August 21, 1987. Additional licensing delay for Shoreham is projected due to complex litigation. Also, licensing delay may occur for Comanche Peak Unit 1, because the duration of the hearing is uncertain. Although a license authorizing fuel loading and precriticality testing for Seabrook Unit 1 has been issued, there is a projected delay for low-power licensing. Full-power licensing for Seabrook Unit 1 will be delayed due to offsite emergency preparedness issues. The length of the delay is not known at this time. With the exception of Seabrook and Shoreham, regulatory delays in this report are not impacted by the schedules for resolving off-site emergency preparedness issues.

8827 **(NUREG/CR—2000-Vol.6-No.10) Licensee event report (LER) compilation for month of October 1987.** (Oak Ridge National Lab., TN (USA)). Nov 1987. Contract AC05-84OR21400. 17p. (ORNL/NSIC—200-Vol.6-No.10). NTIS, PC A03/MF A01 - GPO. Order Number TI88003208/JAW.

This monthly /report contains Licensee Event Report (LER) operational information that was processed into the LER data file of the Nuclear Safety Information Center (NSIC) during the one month period identified on the cover of the document. The LERs, from which this information is derived, are submitted to the Nuclear Regulatory Commission (NRC) by nuclear power plant licensees in accordance with federal regulations. Procedures for LER reporting for revisions to those events occurring prior to 1984

are described in NRC Regulatory Guide 1.16 and NUREG-1061, Instructions for Preparation of Data Energy Sheets for Licensee Event Reports. For those events occurring on and after January 1, 1984, LERs are being submitted in accordance with the revised rule contained in Title 10 Part 50.73 of the Code of Federal Regulations (10 CFR 50.73 - Licensee Event Report System) which was published in the Federal Register (Vol. 48, No. 144) on July 26, 1983.

2108 Economics

REFER ALSO TO CITATION(S) 8378, 8552, 8806

8828 Portfolio analysis model of the demand for nuclear power plants. Sutherland, R.J. (Los Alamos National Lab., NM, USA). *Energy Economics;* 8: No. 4, 218-226([1987]).

Electric utilities are characterized as timid risk averters that select coal or nuclear plants or both, where the levellized cost of each is characterized by considerable risk. A portfolio selection model is developed to explain the historical demand for nuclear reactors by region. Some qualitative policy implications are derived with respect to the DOE's objective of reviving the nuclear power market.

22 NUCLEAR REACTOR TECHNOLOGY

2201 Theory And Calculation

8829 (AERE-R—11865) RKFB: a reactor kinetic code with feedback. Lemay, F.; Needham, J. (UKAEA Atomic Energy Research Establishment, Harwell. Materials Physics and Metallurgy Div.). Nov 1985. 43p. H.M. Stationery Office, London, price Pound 5.00.

The report describes a new improved and extended version of the space independent point kinetics code RKF1, which provides a range of reactivity input options, trip control absorbers and a multiple lumped parameter temperature feedback model applicable to Materials Testing Reactors of the DIDO class. A reactivity controller option permits simulation of an automatic control system. Data input is in free format and the output includes a comparative graphical display of the results for several different problems which may be solved in a single computer run.

8830 (CEA-CONF—9030) FLICA IV: a computer code for multidimensional thermal analysis of nuclear reactor core. Numerical methods for three dimensional two-phase flow. Raymond, P. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Dept. d'Etudes Mecaniques et Thermiques). Apr 1987. 11p. (CONF-870424—). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88750655/JAW.

From American Nuclear Society international meeting on advances in reactor physics, mathematics and computation; Paris, France (27 Apr 1987).

The FLICA IV computer code is devoted to the thermal analysis of nuclear reactor core, it includes an interactive environment for pre and post processing and computational modules for three dimensional two phase flow transient computations. This paper will describe developed numerical methods for 3-D two phase flow transients. 4 refs.

2202 Components And Accessories

REFER ALSO TO CITATION(S) 8884, 8915, 9028, 9166, 9324, 9327

8831 (CONF-870839—6) Kinetics and mechanism of thermal aging embrittlement of duplex stainless steels. Chung, H.M.; Chopra, O.K. (Argonne National Lab., IL (USA)). Jun 1987. Contract W-31109-ENG-38. 32p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88002987/JAW.

From 3. international symposium on environmental degradation of materials in nuclear power systems: water reactors; Traverse City, MI, USA (30 Aug 1987).

Microstructural characteristics of long-term-aged cast duplex stainless steel specimens from eight laboratory heats and an actual component from a commercial boiling water reactor have been investigated by scanning electron microscopy (SEM), transmission electron microscopy (TEM), small angle neutron scattering (SANS), and atom probe field ion microscopy (APFIM) techniques. Three precipitate phases, i.e., Cr-rich α' and the Ni- and Si-rich G phase, and γ_2 austenite, have been identified in the ferrite matrix of the aged specimens. For CF-8 grade materials, $M_{23}C_6$ carbides were identified on the austenite-ferrite boundaries as well as in the ferrite matrix for aging at $\geqq$ 450°C. It has been shown that Si, C, and Mo contents are important factors that influence the kinetics of the G-phase precipitation. However, TEM and APFIM analyses indicate that the embrittlement for $\leqq$400°C aging is primarily associated with Fe and Cr segregation in ferrite by spinodal decomposition. For extended aging, e.g., 6 to 8 years at 350 to 400°C, large platelike α' formed by nucleation and growth from the structure produced by the spinodal decomposition. The Cr content appears to play an important role either to promote the platelike α' (high Cr content) or to suppress the α' in favor of γ_2 precipitation (low Cr). Approximate TTT diagrams for the spinodal, α', G, γ_2, and the in-ferrite $M_{23}C_6$ have been constructed for 250 to 450°C aging. Microstructural modifications associated with a 550°C reannealing and a subsequent toughness restoration are also discussed. It is shown that the toughness restoration is associated primarily with the dissolution of the Cr-rich region in ferrite.

8832 (INIS-mf—11030) Work of the Thermomechanics Department for Nuclear Power and Industrial Thermal Technology. Hlavacka, V. (International Atomic Energy Agency, Vienna (Austria)). 1986. 10p. (In Czech). (CONF-8610359—). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88700771/JAW.

From Scientific and technical conference on the occasion of 40th anniversary of establishment of SVUSS; Prague, Czechoslovakia (9 Oct 1986).

The research tasks of the institute in the field of thermohydraulics of nuclear power facilities were focused on the study of the safety of internals of WWER reactors in loss of coolant accidents, on experimental determination of the laws of the boiling crisis during flow of the coolant through fuel elements of WWER-440 and WWER-1000 reactors, the development of the VEVERKA program for finding the point of the greatest heat load of the coolant, and on the building of a bank of experimental data on the boiling crisis in nuclear reactor fuel elements. Other studies were devoted to problems of sodium-water steam generators of fast breeder reactors. Also resolved was a number of problems relating to heat transfer. The experimental research used mathematical modelling and a number of developed experimental and measuring devices. (J.B.).

8833 Methods and apparatus for reducing corrosion in refractory linings. Poeppel, R.B.; Greenberg, S.; Diercks, D.R. (to Dept. of Energy, Washington, DC). US Patent 4,705,563. 10 Nov 1987. Filed date 23 Oct 1986. vp. Patent and Trademark Office, Box 9, Washington, DC 20232.

A process is described for maintaining chromium ions in a +3 valence state. The valence of the chromium ions is determined by the temperature and the oxygen partial pressure at the chromium ions. The process comprises the steps of: maintaining the chromium ions at a temperature between about 1600°C and 1800°C; and introducing a gas mixture through a porous refractory wall of a vessel in which the porous refractory wall includes the chromium ions. The gas mixture maintains an oxygen partial pressure between about 10/sup -10/ and 10/sup -8/ atmospheres at the chromium ions. The gas chemically protects the chromium ions to control the valence state of the chromium ions.

8834 Survey of operating experience to identify structural degradation of nuclear power plant components. Murphy, G. (Oak Ridge National Lab., TN, USA). *International Journal of Pressure Vessels and Piping;* 22: No. 1, 31-40(1986).

An assessment was performed of the information available from operation of United States nuclear power plants in their Licensee Event Reports (LERs) which is pertinent to identifying failures due to age-related degradation. LERs from commercial power

plants submitted from 1969 to 1982 were surveyed, yielding 3098 events that were considered to be age-related failures. Wear, corrosion, fatigue, vibration, stress corrosion, and erosion were identified as the structural failure cause mechanisms in over half of the events. The study contains data on failed components, the age-related failure mechanisms responsible, the severity of the failures, and the failure detection methods of failures from possible age-related causes.

8835 **Joint probabilities of partially coupled events.** Teichmann, T. (Brookhaven National Lab., Upton, NY, USA). *Reliability Engineering;* 14: No. 2, 133-148(1986).

This paper considers the joint and conditional probabilities of a number of (not necessarily identical) components which are all influenced to variable degrees by a single common extraneous factor. Explicit formulae are derived for these probabilities for specific values or statistical distributions of the common perturbing factor.

2203 Fuel Elements

REFER ALSO TO CITATION(S) 8856, 8883, 8901, 8945

8836 **(CONF-8709189—1) Innovative concepts for fuel plate fabrication.** Domagala, R.F.; Wiencek, T.C.; Thresh, H.R. (Argonne National Lab., IL (USA)). Oct 1987. Contract W-31109-ENG-38. 12p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88002828/JAW.

From International RERTR meeting; Buenos Aires, Argentina (28 Sep 1987).

A number of fabrication concepts have been and are being explored at ANL. Although specific processes were addressed with silicide fuels in mind, most are applicable to fabrication with any fuel type. Processes include improved comminution procedures for converting U-Si alloy ingots to powder using a roll crusher and an impact mill. Aluminizing of core compacts by ion vapor deposition techniques in vacuum offers prospects for improved plate quality. Other items examined include the possible use of coatings on fuel particles, matrices different from pure Al, and ductile fuel alloys which might be used to produce fuel plates with uranium loadings higher than possible with conventional dispersed-phase powder metallurgy technology.

8837 **(FEI—1789) Calculating the coolant spatial flow and temperature distribution in fuel assemblies on the base of the by-cell approach.** Veremeev, A.A.; Kumaev, V.Ya.; Leonchuk, M.P. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk. Fiziko-Ehnergeticheskij Inst.). 1986. 22p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88700843/JAW.

Consideration is being given to the technique and results of numerical simulation of three-dimensional fields of coolant velocity and temperature in fuel element clusters with partial blocking of pass openings. The calculation technique is based on numerical solution of the equations of pulse, mass and energy conservation for reference volumes, formed by fuel element cluster divided by triangular grid system. Calculational results for velocity, temperature and pressure fields are compared with published experimental data. A conclusion is made concerning applicability and satisfactory accuracy of the applied method for calculation of complex three-dimensional flows with strong disturbances. 17 refs.; 14 figs.

8838 **(FEI—1821) Mathematical simulation of major strains in hollow column of a cylindrical fuel rod.** Khmelevskij, M.Ya.; Malakhova, E.I.; Klimakova, T.N.; Dolmatov, P.S. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk. Fiziko-Ehnergeticheskij Inst.). 1986. 11p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88700846/JAW.

Results of mathematical simulation of major strains, occuring under the swelling of hollow cylindrical column of a fuel rod, placed into hard coating are presented. Strain-stress state of fissile material, its free swelling being described in terms of spheric gas pore model, is considered on the basis of the finite strain theory. A system of ordinary differential equations is derived, describing considerable form change of the internal hollow of cylinder out of fissile material under its constrained swelling in hard coating. Results of numeric integration and analytical solution of the derived differential equations for a wide spectrum of the model parameter values are presented. 6 refs.; 4 figs.

8839 **(Juel-Spez—407) Safety analysis report of uranium dioxide fuel laboratory, Nuclear Research Centre Inchas, Egypt.** Abdel-Azim, M.S.; Abdel-Halim, A. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Zentralabteilung Brennelement- und Bestrahlungstechnologie; Nuclear Research Centre, Inshas (Egypt)). Jul 1987. 34p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88751526/JAW.

In the Nuclear Research Center Inchas a uranium dioxide fuel laboratory is planned and built by the AEA Cairo (Atomic Energy Authority). The layout of this fuel lab and the programmatical contents are subject to the bilaterial cooperation between Egypt and the Federal Republic of Germany. In this report the safety analysis as basic items for the approval procedure are started in detail.

2204 Control Systems

REFER ALSO TO CITATION(S) 8914

8840 **(CEA-CONF—9039) Advances in in-core and ex-core nuclear instrumentation in the French PWRs.** Darraud, A.; Berthet, A.; Colling, J.M.; Schwartz, J.P. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Dept. d'Etudes Mecaniques et Thermiques). Apr 1987. 16p. (CONF-870424—). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88750656/JAW.

From American Nuclear Society international meeting on advances in reactor physics, mathematics and computation; Paris, France (27 Apr 1987).

Significant advances on both ex-core and in-core instrumentation and protection system have been achieved in France within the last eight years. The most significant achievement is the design, qualification and implementation of the multisection ex-core detectors which are part of the new Integrated Digital Protection System (SPIN) installed on all the 1300 MWe plants in France. Before this, theoretical works and on-reactor tests have been done, starting in 1978 on the BUGEY-2 reactor with a prototype detector, continued in 1981-82 with a protection system mock-up on TRICASTIN-3. These results made it possible to design the new protection system of the 1300 MWe plant program, the first units on operation being PALUEL 1 and 2, which came on line in 1984. During the last years, other tests were made, using fixed in-core instrumentation based on core outlet thermocouples, self-powered detectors and gamma thermometers. The use of this kind of instrumentation is presently being contemplated, probably as a complement of the present instrumentation.

8841 **(CONF-870832—7) A generalized system state analyzer for plant surveillance.** Mott, J.; King, R.; Radtke, W. (EI International, Inc., Idaho Falls, ID (USA); Argonne National Lab., Idaho Falls, ID (USA)). 1987. Contract W-31109-ENG-38. 18p. NTIS, PC A03. Order Number DE88003027/JAW.

From Topical meeting on artificial intelligence and other innovative computer applications in the nuclear industry; Snowbird, UT, USA (31 Aug 1987).

A very general mathematical framework for embodying learned data from a complex system and combining it with a current observation to estimate the true current state of the system has been implemented using nearly universal pattern-recognition algorithms and applied to surveillance of the EBR-II power plant. In this application the methodology can provide signal validation and replacement of faulty signals on a near-real-time basis for hundreds of plant parameters. The mathematical framework, the pattern-recognition algorithms, examples of the learning and estimating process, and plant operating decisions made using this methodology are discussed. The entire methodology has been reduced to a set of

FORTRAN subroutines which are small, fast, robust and executable on a personal computer with a serial link to the system's data acquisition computer, or on the data acquisition computer itself.

8842 **(EPRI-NP—5504-Vol.2) Simulator qualification plan: Volume 2, Appendixes: Final report.** Pellechi, M.S.; Schmidt, P.M. (General Physics Corp., Columbia, MD (USA)). Nov 1987. 253p. Reports Research Center, Box 50490, Palo Alto, CA 94303. Order Number TI88920096/JAW.

Qualification of a nuclear power plant training simulator involves both validation and verification. Response of the simulator in duplicating various training scenarios are validated against reference plant data, similar plant data, engineering code output data, or best estimate judgement. Verification involves confirming the accuracy of the simulator. The EPRI plan for simulator qualification described in this report details the procedures to validate the performance of the simulator and to verify its compliance with applicable regulatory requirements. An estimate of the resources to conduct this plan is included as are the necessary forms to document performance.

8843 **(NUREG/CR—4862-Vol.2) Cognitive environment simulation: An artificial intelligence system for human performance assessment: Modeling human intention formation: [Technical report, May 1986-June 1987].** Woods, D.D.; Roth, E.M.; Pople, H. Jr. (Westinghouse Research and Development Center, Pittsburgh, PA (USA)). Nov 1987. 135p. NTIS, PC A07/MF A01 - GPO. Order Number TI88900192/JAW.

This report documents the results of Phase II of a three phase research program to develop and validate improved methods to model the cognitive behavior of nuclear power plant (NPP) personnel. In Phase II a dynamic simulation capability for modeling how people form intentions to act in NPP emergency situations was developed based on techniques from artificial intelligence. This modeling tool, Cognitive Environment Simulation or CES, simulates the cognitive processes that determine situation assessment and intention formation. It can be used to investigate analytically what situations and factors lead to intention failures, what actions follow from intention failures (e.g., errors of omission, errors of commission, common mode errors), the ability to recover from errors or additional machine failures, and the effects of changes in the NPP person-machine system. The Cognitive Reliability Assessment Technique (or CREATE) was also developed in Phase II to specify how CES can be used to enhance the measurement of the human contribution to risk in probabilistic risk assessment (PRA) studies. 43 refs., 20 figs., 1 tab.

8844 **(NUREG/CR—4862-Vol.3) Cognitive environment simulation: An artificial intelligence system for human performance assessment: Cognitive reliability analysis technique: [Technical report, May 1986-June 1987].** Woods, D.D.; Roth, E.M. (Westinghouse Research and Development Center, Pittsburgh, PA (USA)). Nov 1987. 76p. NTIS, PC A05/MF AO1 - GPO. Order Number TI88900193/JAW.

This report documents the results of Phase II of a three phase research program to develop and validate improved methods to model the cognitive behavior of nuclear power plant (NPP) personnel. In Phase II a dynamic simulation capability for modeling how people form intentions to act in NPP emergency situations was developed based on techniques from artificial intelligence. This modeling tool, Cognitive Environment Simulation or CES, simulates the cognitive processes that determine situation assessment and intention formation. It can be used to investigate analytically what situations and factors lead to intention failures, what actions follow from intention failures (e.g., errors of omission, errors of commission, common mode errors), the ability to recover from errors or additional machine failures, and the effects of changes in the NPP person-machine system. The Cognitive Reliability Assessment Technique (or CREATE) was also developed in Phase II to specify how CES can be used to enhance the measurement of the human contribution to risk in probabilistic risk assessment (PRA) studies. 34 refs., 7 figs., 1 tab.

8845 **(RISO-M—2512) Risk Analysis Group annual progress report 1984.** (Risoe National Lab., Roskilde (Denmark)). Jun 1985. 24p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88751476/JAW.

The activities of the Risk Analysis Group at Risoe during 1984 are presented. These include descriptions in some detail of work on general development topics and risk analysis performed as contractor.

8846 **(RISO-M—2513) Human risk contributions in process industry: Guides for their pre-identification in well-structured activities and for post-incident analysis.** Pedersen, O.M. (Risoe National Lab., Roskilde (Denmark)). May 1985. 70p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE88751477/JAW.

The report should be considered a guide for the treating of human errors: for identifying their possibilities of occurrence when designing well-structured human tasks and for their improvement when they occur in reality. For these purposes a strong coupling between predictive and retrospective analysis is emphasized: In order to control human errors, post-incident analysis of cases with human errors in a given industrial plant should be performed as means of feedback from reality for the verification of results of predictive analysis and also as general means of identifying and improving such human errors which cannot be expected covered by predictive analysis. Primarily, the guide addresses people with a knowledge of the technical plant in question and involved in the safety-oriented design and improvement of human activities and without a particular human factors background. The main report describes the procedures for post-incident analysis and for Work Analysis, which is a search strategy developed for well-defined activities, e.g. test and calibration, and constitutes a formalized procedure for the pre-identification of relevant human errors leading to a lack of task result and/or to immediate effects not covered by the lack of task result itself. Work Analysis and the post-incident analysis procedure are based on a common description system for human malfunctions. This system is explained in appendix and so are its underlying models and way of reasoning. Finally, a word index is provided for supporting the reader.

2205 Environmental Aspects

REFER ALSO TO CITATION(S) 8540, 8789, 8821, 8869, 8878, 8883, 8892, 8900, 8901, 8903, 8904, 8905, 8906, 8918, 8923

8847 **(AERE-R—12182) Possible impact of atmospheric radioactive discharges from UK nuclear installations on acid deposition.** Eggleton, A.E.J. (UKAEA Atomic Energy Research Establishment, Harwell. Environmental and Medical Sciences Div.). Mar 1986. 9p. H.M. Stationery Office, London, price Pound 4.00.

The effect of atmospheric radioactive emissions from United Kingdom nuclear installations on acid deposition is assessed. Nitrogen oxide and ozone production resulting from and associated with discharges of airborne radioactivity, comparison with conventional emissions, and the direct effects of radioactive emissions on trees, are all discussed.

8848 **(CEGB-TPRD/B—0704/N85) Attachment of gaseous fission products to aerosols.** Skyrme, G. (Central Electricity Generating Board, Berkeley (UK). Berkeley Nuclear Labs.). Jul 1985. 37p. (ARPWG/P—85-57). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88750717/JAW.

The circumstances under which gaseous fission products may be attached to aerosols are examined. A simple model is assumed for the interaction between the fission product molecules and the aerosol, in which the probability of attachment of a molecule on any encounter is given by a constant α, the sticking probability. It is concluded that when gaseous fission products are released in the presence of a population of particles, particularly small particles, there is a strong possibility that they will attach rapidly to those particles. In such circumstances gaseous fission product transport would be governed by the transport properties of the particles.

8849 **(CEGB-TPRD/B—0720/N85) Assessment of the radiological significance of accidental releases of radionuclides to coastal waters.** Maul, P.R. (Central Electricity Generating Board, Berkeley (UK). Berkeley Nuclear Labs.). Oct 1985. 29p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88750715/JAW.

Methods are described which enable the radiological consequences of an accidental release of activity to an estuary or sea to be assessed, assuming the release is in the same physical and chemical form as routine discharges. Critical group and collective exposures are considered for the most important seafood ingestion and external radiation pathways. Detailed consideration is given to the interaction of activity with marine sediments, and this enables a more realistic description of any resulting radiation exposure to be given than is possible by using existing mathematical models more suited to extended releases of radionuclides. The methods employed constitute an interesting use of a powerful technique involving the numerical inversion of Laplace transformed quantities.

8850 **(CONF-8710111—9) The microstructural and microchemical characterization of samples from the TMI-2 core.** Neimark, L.A.; Strain, R.V.; Sanecki, J.E.; Jackson, W.D. (Argonne National Lab., IL (USA)). Oct 1987. Contract W-31109-ENG-38. 12p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88002889/JAW.

From 15. water reactor safety information meeting; Gaithersburg, MD, USA (26 Oct 1987).

Samples of materials from various regions of the TMI-2 reactor core and vessel have been examined at Argonne National Laboratory with a variety of microanalytical techniques. The purpose of these examinations is to characterize the microstructure and microchemistry of the materials so that their origin could be determined, their fission-product content evaluated, and their role in the accident scenario assessed. Macroscopic and microscopic composition inhomogeneities in melted fuel from different reactor locations indicate different cooling rates and solidification temperatures. The mobility of molten fuel could have been enhanced by a low temperature eutectic in the Fe-Cr-O system. Stainless steel-clad Ag-In-Cd control rods could have failed from a eutectic reaction between the Zircaloy guide tubes and the cladding. Significant concentrations of fission-products were not found, but their release from the fuel did not appear to be enhanced by gas-generated channels along grain boundaries.

8851 **(DOE/SSDP—0028) Removal of Shippingport Station primary system components and piping.** LaGuardia, T.S.; Lipsett, S.M. (TLG Services, Inc., Bridgewater, CT (USA); Cleveland Wrecking Co., OH (USA)). 1987. Contract AC06-76RL01857;AC06-84RL10421. 17p. (CONF-871018—16). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88001859/JAW.

From International decommissioning symposium; Pittsburgh, PA, USA (4 Oct 1987).

The primary system components within this workscope consist of the stainless steel reactor coolant piping, check valves, reactor coolant pumps, steam generators, and reactor purification demineralizers and coolers. The four reactor coolant pumps, the four check valves, and several sections of reactor coolant piping were removed and shipped to a laboratory for metallographic examination. This paper describes the work performed, the heavy rigging preparations and procedures, the cutting tools used, component draining/capping techniques to prevent spills, contamination containment, airborne control techniques, and lessons learned during the removal of these primary system components. Summaries of crew size and composition, labor hours, duration hours and radiation exposure to workers are provided and discussed briefly. 6 figs.

8852 **(INIS-GB—30) EDRP public local inquiry, UKAEA/BNFL precognition on: General environmental aspects.** Driver, P.A. (UKAEA Headquarters, London; British Nuclear Fuels Ltd., Risley). Jan 1986. 94p. (DP—12). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88750754/JAW.

Details of the existing environment of the proposed EDRP site and its environs are presented. An assessment is made of the expected impact of the construction and operation of EDRP at the Dounreay Nuclear Establishment. Relevant extracts from the Environmental Impact Assessment, published by the Applicants, are included.

8853 **(INIS-GB—38) Monitoring of beach contamination following an incident at BNFL, Sellafield, Cumbria in November 1983. Results to July 1984.** (Department of the Environment, London (UK); Ministry of Agriculture, Fisheries and Food, London (UK)). 1985. 89p. NTIS (US Sales Only), PC A05/MF A01. Order Number DE88750798/JAW.

This report jointly produced by RCI/DOE and MAFF presents for the period from November 1983 to July 1984: 1) the monitoring programmes and techniques used by BNFL, DOE and MAFF; 2) the results of the monitoring programmes; 3) actions taken as a consequence of the monitoring results; 4) an outline of the position at the end of July 1984 when the Secretary of State for Environment announced, after consultation with MAFF, the DHSS and NRPB, withdrawal of advice to avoid unnecessary use of the beaches.

8854 (INIS-mf—11048, pp 178) **Possibility for radiation monitoring optimization in the region of NPP Kozloduj.** Khristova, M.; Paskalev, Z. (Meditsinska Akademiya, Sofia, Bulgaria. Nauchen Inst. po Rentgenologiya i Radiobiologiya). Oct 1985. (In Bulgarian). NTIS (US Sales Only), PC A09/MF A01. Order Number DE88780035/JAW. (CONF-8510479—).

From 6. national congress of roentgenology, radiology and radiobiology; Sofia, Bulgaria (4 Oct 1985).

8855 (INIS-mf—11048, pp 178-179) **Seasonal radiation doses distribution for the population of the region of NPP Kozloduj.** Khristova, M. (Meditsinska Akademiya, Sofia, Bulgaria. Nauchen Inst. po Rentgenologiya i Radiobiologiya). Oct 1985. (In Bulgarian). NTIS (US Sales Only), PC A09/MF A01. Order Number DE88780035/JAW. (CONF-8510479—).

From 6. national congress of roentgenology, radiology and radiobiology; Sofia, Bulgaria (4 Oct 1985).

8856 (IWGFPT—27, pp 183-196) **Diffusion and behaviour of iodine and rubidium in UO_2 and ThO_2.** Matzke, H.; Ray, I.L.F.; Verrall, R.A. (Commission of the European Communities, Karlsruhe, Federal Republic of Germany; Atomic Energy of Canada Ltd., Chalk River). 1987. NTIS (US Sales Only), PC A12/MF A01. Order Number DE88900151/JAW. (CONF-8611109—).

From IAEA technical committee meeting on water reactor fuel behaviour and fission products release in off-normal and accident conditions; Vienna, Austria (10 Nov 1986).

The actinide oxides of the fluorite structure, UO_2 and $(U,Pu)O_2$ are used as fuels in nuclear reactors. ThO_2 and mixed oxides $(U,Th)O_2$ are considered as fuels for the future. During operation, fission creates volatile fission products: Te, Br, I, Rb, Cs, Kr, and Xe. Whereas much information is available on the diffusion and the behaviour of the rare gases, relatively little is known for the other volatile elements. The defect structure of the oxides is well understood, based on a large number of measurements of self-diffusion and on theoretical calculations. The existing knowledge is reviewed as basis for understanding measurements of iodine and rubidium behaviour. Radioactive tracers were used for diffusion (and release) measurements of Rb and I, and transmission electron microscopy was employed to investigate larger defects, precipitation of I and Rb and their behavior as function of temperature (room temperature to 1800°C). At concentrations of the level of 1 at. %, both elements form precipitates (or bubbles at elevated temperatures).

8857 **(KFKI—1987-38/K) Real-time computing in environmental monitoring of a nuclear power plant.** Deme, S.; Lang, E.; Nagy, Gy. (Hungarian Academy of Sciences, Budapest. Central Research Inst. for Physics). Jun 1987. 14p. (CONF-870619—). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88700777/JAW.

From Application of computer technology to radiation protection; Bled, Yugoslavia (22 Jun 1987).

A real-time computing method is described for calculating the environmental radiation exposure due to a nuclear power plant both at normal operation and at accident. The effects of the Gaussian plume are recalculated in every ten minutes based on meteorological parameters measured at a height of 20 and 120 m as well as on emission data. At normal operation the quantity of radioactive materials released through the stacks is measured and registered while, at an accident, the source strength is unknown and the calculated relative data are normalized to the values measured at the eight environmental monitoring stations. The doses due to noble gases and to dry and wet deposition as well as the time integral of /sup 131/I concentration are calculated and stored by a professional personal computer for 720 points of the environment of 11 km radius. 7 refs.; 2 figs.

8858 **(NRPB-DL—10) Derived emergency reference levels for the introduction of countermeasures in the early to intermediate phases of emergencies involving the release of radioactive materials to atmosphere.** Linsley, G.S.; Crick, M.J.; Simmonds, J.R.; Haywood, S.M. (National Radiological Protection Board, Chilton (UK)). Mar 1986. 43p. H.M. Stationery Office, London, price Pound 5.00.

Derived Emergency Reference Levels (DERLs) are practical quantities intended for use in the aftermath of an accident involving the release of radioactive materials to atmosphere and for use in preparing emergency plans for the protection of the public. The results of environmental measurements may be compared with them as a means of assessing the seriousness of the release and in order to form judgements on the need to institute protective countermeasures. DERLs are the practical expression of Emergency Reference Levels, the radiological criteria for planning the introduction of emergency countermeasures. DERLs have been evaluated for a range of radionuclides which could be released in the event of an accident and for a number of different exposure pathways that are relevant in the initial phase of an accident. These pathways are: inhalation of activity both in the plume and resuspended from the ground; skin irradiation by β-emitting noble gases in the cloud; doses from β-emitters deposited on the skin; and external γ irradiation from ground deposits.

8859 **(NRPB-R—182) NRPB emergency data handbook.** White, I.F. (National Radiological Protection Board, Chilton (UK)). Mar 1986. 79p. H.M. Stationery Office, London, price Pound 6.00.

The NRPB Emergency Data Handbook is a compilation of useful data on the radiological aspects of civil nuclear emergencies. It is intended to be used by NRPB staff in their advisory role during emergencies (or more probably during emergency exercises), and also as an aid to other UK organisations involved in contingency planning. The radiological data are currently recommended by NRPB for those purposes; non-radiological data have been taken wherever possible from authoritative UK sources. NRPB-R182 contains the same information as the current edition of the NRPB Emergency Data Handbooks which are distributed to official bodies involved in the UK civil nuclear emergency arrangements. Unlike the official user Handbooks, NRPB-R182 cannot be regularly updated in detail, and is intended for general reference only.

8860 **(NUREG/CR—5017) Limestone concrete aerosol experiments in steam-air atmospheres: NSPP [Nuclear Safety Pilot Plant] Tests 521, 522, and 531: Data record report.** Tobias, M.L.; Adams, R.E. (Oak Ridge National Lab., TN (USA); Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Regulatory Research). Oct 1987. Contract AC05-84OR21400. 60p. (ORNL/TM—10587). NTIS, PC A04/MF A01 - GPO. Order Number TI88001407/JAW.

This data record report summarizes the results from two tests involving limestone concrete test aerosol in a steam-air environment and one test in a dry air environment. This research sponsored by the US Nuclear Regulatory Commission was conducted in the Nuclear Safety Pilot Plant at the Oak Ridge National Laboratory. The purpose of this project is to provide a data base on the behavior of aerosols in containment under conditions assumed to occur in postulated LWR accident sequences; this data base will provide experimental validation of aerosol behavioral codes under development. In the report a brief description is given of each test together with the results in the form of tables and graphs. Included are data on aerosol mass concentration, aerosol fallout and plateout rates, total mass fallout and plateout, aerosol particle size, vessel atmosphere pressure, vessel atmosphere temperatures, temperature gradients near the vessel wall, and steam condensation rates on the vessel wall.

2206 Research, Test, And Experimental Reactors

REFER ALSO TO CITATION(S) 8805, 10654

8861 **(CONF-871101—73) Overview of reduced enrichment fuels: Development, testing, and specification.** Snelgrove, J.L. (Argonne National Lab., IL (USA)). 1987. Contract W-31109-ENG-38. 7p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE88003038/JAW.

From Joint meeting of the American Nuclear Society and the Atomic Industrial Forum; Los Angeles, CA, USA (15 Nov 1987).

The US Reduced Enrichment Research and Test Reactor (RERTR) Program was established in 1978 to provide the technical means to operate research and test reactors with low enrichment uranium (LEU) fuels without significant penalty in experiment performance, operation costs, component modifications, or safety characteristics. This paper discusses relevant developments in fuel developments. 9 refs., 1 tab.

8862 **(CONF-8709189—2) Evaluation and selection of hot channel (peaking) factors for research reactor applications.** Woodruff, W.L. (Argonne National Lab., IL (USA)). 1987. Contract W-31109-ENG-38. 11p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88002934/JAW.

From International RERTR meeting; Buenos Aires, Argentina (28 Sep 1987).

A proposed method for selecting and applying hot channel factors is presented along with some justification for these selections. The method is illustrated by example, and the sensitivity to some of the choices is examined. The uncertainty in the heat transfer coefficient is a major contributor to the reduction in thermal-hydraulic safety margins. The uncertainty introduced by the heterogeneity in the fuel is another important contributor and an area where more information may be useful in reducing this uncertainty.

8863 **(IAE—4216/14) Double bent channel of the IR-8 reactor for experiments with very slow neutrons.** Arzumanov, S.S.; Buslaev, V.S.; Erozolimskij, B.G.; Masalovich, S.V.; Strepetov, A.N.; Fedunin, V.P.; Frank, A.I.; Yashin, A.F.; Yatsenko, B.A. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii). 1985. 9p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88700848/JAW.

Special neutron guide aimed at very slow neutron extraction and also the source of ultracold neutrons with distilled water converter are described. Efficiency of ultracold neutron extraction is presented, velocity spectrum of the extracted neutrons is determined. The guide consists of two horizontally bent 12Kh18N10T stainless steel tubes 159x4 mm in diameter. The tubes are placed one above the other and are mutually joined by a short inclined section, approximately 30 cm far from the end of lower tube, that enters in the reactor core berillium reflector. The upper tube is horizontal, the lower is slightly inclined to the horizon. Vertical distance between tubes in attaching point is ~ 25 cm, and at the outlet from biological shielding is ~ 50 cm. Prospects for the guide application are bound up with changes to low-temperature converters, in particular, to parahydrogen one. Gaseous helium cooled cryogenic loop aimed at cooling such converter is designed, pro-

duced and tested. The above-mentioned specialized guide was erected during recostruction of IRT-M reactor. 6 refs.; 6 figs.

8864 **(ITEF—10-1986) Calculation of transition to the stationary mode of the TVR-M upgraded reactor.** Mikhajlov, V.M.; Martsymova, L.A. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1986. 23p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88700439/JAW.

Heterogeneous calculations of initial operating cycles of the TVR-M research reactor after its first criticality are carried out. Fresh fueling for the first cycle as well as fresh and 1/3 spent fueling for the second cycle are determined. It is shown that the third cycle does not practically differ from the stationary one. Distribution of energy release by fuel assemblies, temperature effect and "weights" of groups of regulators and certain control rods are calculated. Comparison of activations in experimental channels for the first and stationary cycles is conducted. 3 refs.; 6 figs.; 9 tabs.

8865 **(ITEF—85-1986) Calculation of the TVR-M reactor operating cycle accounting nonuniformity of fuel burnup.** Mikhajlov, V.M.; Martsymova, L.A. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1986. 32p. (In Russian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88700447/JAW.

Neutronics calculations of the upgraded TVR-M reactor operating cycle with account of nonuniformity of fuel burnup through the core are carried out. Dependence of axial burnup on time for every fuel assembly (FA) is obtained. Medium discharged fuel burnup for initial and stationary reactor operating cycle is determined. Axial power distribution history in fuel for a cycle is studied. Comparison with the results of similar calculations carried out disregarding nonuniformities of fuel burnup is conducted. 7 refs.; 12 figs.; 1 tab.

8866 **(NIIAR—1(682)) NIIAR experimental reactors and in-pile experimental techniques.** Tsykanov, V.A.; Kuprienko, V.A.; Kuznetsov, A.I. and others. (Nauchno-Issledovatel'skij Inst. Atomnykh Reaktorov, Dimitrovgrad (USSR)). 1986. 22p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88700933/JAW.

Problems related with the NIIAR experimental possibilities for performing research on reactor materials testing are considered. Neutron-physical and operational characteristics of the SM-2 and MIR reactors were essentially improved in result of reconstruction. New RBT-6 and RBT-10 pool type reactors using spent fuel assemblies of the SM-2 reactor were created. The complex of capsules enabling to realize the required temperature conditions during irradiation of reactor material samples with up to 5x1/sup 6/ W/m/sup 2/ surface heat flux density was designed. Techniques and capsules for testing high-temperature gas cooled VTGR type reactor fuel elements were created. Techniques for corrosion resistance testing of zirconium base alloys, as well as the materials for fuel cans and channel tubes of the WWER and RBMK type reactors were developed. The original irradiation devices and techniques enabling to test fuel elements at alternating power are installed in SM-2 and MIR reactors in connection with development of NPPs operating under intake load following conditions (maneuvering conditions). 8 refs.

8867 **(SURRC—74-86) Report on session 1984-1985.** Wilson, H.W. (Scottish Universities Research and Reactor Centre, Glasgow (UK)). 1985. 46p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88750697/JAW.

During this session the centre changed ownership, so that as from 1st October 1985 it will be operated by Edinburgh, Glasgow and Strathclyde Universities. Aberdeen and St. Andrews are associate members for access to the isotope geology facilities. Other Universities will use the centre on a commercial basis. The research activities are summarized; these are divided into reactor related activities with brief outlines of the projects undertaken in radiochemistry and physics, health physics and nuclear medicine and engineering. The number of analyses undertaken in isotope Geology increased to over 4,000. Sulphur isotope techniques were introduced during the year. The work at the NERC radiocarbon laboratory is also described. The teaching aspects of the reactor and its operation during the year are recorded. There were no problems with the reactor operation and it achieved its highest energy output of 232.5MWH. (U.K.).

8868 **New facility for averaged resonance capture studies at the Omega West reactor.** Stelts, M.L.; Bendt, P.J. (Los Alamos National Lab., NM, USA). *Nuclear Instruments and Methods in Physics Research;* 258: No. 2, 195-200(1 Aug 1987). Contract W-7405-ENG-36.

A facility has been developed at the Omega West reactor at Los Alamos to provide neutron beams of 2 and 24 keV average neutron energies. The neutron beam currents are comparable with those obtained at the Brookhaven high flux beam reactor. A three-crystal pair spectrometer has been developed to allow acquisition of high resolution primary neutron capture gamma ray spectra. This will be used for nuclear spectroscopy and structure studies.

8869 **Investigation of nonrecoil fission-product release phenomena using multifrequency source-perturbation experiments in EBR-II.** Gross, K.C.; Polley, L.K. (Argonne National Lab., IL, USA; Iowa State Univ. of Science and Technology, Ames, USA). *Annals of Nuclear Energy;* 13: No. 8, 419-441(1986).

A widely-accepted theory that was proposed to explain nonrecoil fission-product release phenomena in LMRs postulated that isotopic transport kinetics are attributable to liquid-state diffusion across a viscous sublayer of Na near the surface of the fuel. A series of multifrequency source-perturbation experiments was recently performed in EBR-II to isolate and quantitatively explore the boundary-layer diffusion mechanism while separating out all other physical variables that affect the isotopic transport kinetics. Detailed analyses of the results using bivariate spectral decomposition and cross-correlation techniques are presented. Results of the analyses provide incontrovertible experimental evidence that boundary-layer diffusion in fact plays no part in the release of short-lived fission products in LMRs. A major conclusion of this investigation is that all nonrecoil fission-product release phenomena originate from mechanisms acting inside the breached element itself. Implications of this and other findings made during this investigation are discussed, and recommendations are made for extending the techniques introduced here in future experiments involving actual breached pins.

2207 Plutonium And Isotope Production Reactors

REFER ALSO TO CITATION(S) 9244

8870 **(DOE/NV/10594—H1) History of the production complex: The methods of site selection.** (History Associates, Inc., Rockville, MD (USA)). Sep 1987. Contract AC08-87NV10594. 108p. NTIS, PC A06/MF A01; 1; GPO Dep. Order Number DE88003237/JAW.

Experience taught the Atomic Energy Commission how to select the best possible sites for its production facilities. AEC officials learned from the precedents set by the wartime Manhattan Project and from their own mistakes in the immediate postwar years. This volume discusses several site selections. The sites covered are: (1) the Hanford Reservation, (2) the Idaho reactor site, (3) the Savannah River Plant, (4) the Paducah Gaseous Diffusion Plant, (5) the Portsmouth Gaseous Diffusion Plant, (6) the Fernald Production Center, (7) the PANTEX and Spoon River Plants, (8) the Rocky Flats Fabrication Facility, and (9) the Miamisburg and Pinellas plants. (JDH)

2209 Reactor Safety

REFER ALSO TO CITATION(S) 8557, 8656, 8792, 8826, 8827, 8856, 8858, 8859, 8860, 8862, 9201, 9202, 9203, 9204, 9205, 9206, 9207, 9208, 9209, 9210, 9211, 9212, 9231, 9232, 9233, 9234, 9235, 9237, 9264, 9324

8871 (AERE-R—11974) **Proceedings of the specialists' workshop on iodine chemistry in reactor safety, September 11th and 12th, 1985 at AERE, Harwell, England.** Deane, A.M.; Potter, P.E. (eds.). (UKAEA Atomic Energy Research Establishment, Harwell. Chemistry Div.). Jan 1986. 365p. (CONF-8509169—). H.M. Stationery Office, London, price Pound 16.00.

From Specialist workshop on iodine chemistry in reactor safety organization for economic cooperation and development; Harwell, UK (9 Sep 1985).

The iodine workshop, held at Harwell in September 1985, provided a forum to study the chemistry of iodine under reactor accident conditions. The major issues discussed were iodine equilibrium and kinetics in aqueous solutions, radiolysis of iodine in aqueous solutions, iodine/boric acid reactions, organic iodine compounds and partition measurements. Other factors must be identified before a complete model of iodine behaviour during reactor accidents can be established. (U.K.).

8872 (AERE-R—11974, pp 7-8) **Introduction and brief description of CSNI [Committee on the Safety of Nuclear Installations].** Royen, J. (Nuclear Energy Agency, 75 - Paris, France. Nuclear Safety Div.). Jan 1986. H.M. Stationery Office, London, price Pound 16.00. (CONF-8509169—).

From Specialist workshop on iodine chemistry in reactor safety organization for economic cooperation and development; Harwell, UK (9 Sep 1985).

An introduction and brief description of the structure of the Committee on the Safety of Nuclear Installations, (CSNI) was given to the iodine workshop. Five principal working groups were defined and their terms of reference stated. Work of experts analysing the consequences of reactor accidents was described. A report containing conclusions of severe accident studies will be published. (U.K.).

8873 (AERE-R—11974, pp 209-224) **Laboratory scale and technical scale investigations concerning iodine water-vapour phase partitioning under severe reactor accident conditions.** Richter, F.; Neeb, K.H. (Kraftwerk Union A.G., Erlangen, Germany, F.R.). Jan 1986. H.M. Stationery Office, London, price Pound 16.00. (CONF-8509169—).

From Specialist workshop on iodine chemistry in reactor safety organization for economic cooperation and development; Harwell, UK (9 Sep 1985).

Experimental investigations have been performed to determine iodine water-vapour partitioning and iodine transport from boric acid solutions of iodide-iodine mixtures. Experiments were performed in open and closed glass equipment at 100°C and 110°C. High temperature tests were performed in a steel pressure vessel, at 170°C. The paper presents an overview of the experimental techniques and results obtained. The results will be used in the IMPAIR code.

8874 (AERE-R—11974, pp 249-250) **Discussion on iodine partitioning between condensed and vapour phases.** Friederichs, H.-G.; Powers, D.; Burns, W.G. (Gesellschaft fuer Reaktorsicherheit m.b.H., GRS, Koeln, Germany, F.R.; Sandia National Labs., Albuquerque, NM, USA; UKAEA Atomic Energy Research Establishment, Harwell. Chemistry Div.). Jan 1986. H.M. Stationery Office, London, price Pound 16.00. (CONF-8509169—).

From Specialist workshop on iodine chemistry in reactor safety organization for economic cooperation and development; Harwell, UK (9 Sep 1985).

A brief description is given of the German Risk Study modelling. The most recent model, IMPAIR, models behaviour in containment up to release of iodine to the environment and considers three iodine species, elemental iodine, organic iodine and iodide. Chemical processes and reactions at stainless steel surfaces are also incorporated into the model. Experimental information from all sources must be incorporated to develop the codes.

8875 (AERE-R—11974, pp 313) **Discussion on iodide/boric acid reactions under severe accident conditions.** Bowsher, B.R.; Dickinson, S.; Blahnik, C.; Powers, D.; Turner, D.J.; Bruce, D.M.; Potter, P.E.; Ishigure, K. (UKAEA Atomic Energy Establishment, Winfrith; Ontario Hydro, Toronto, Canada; Sandia National Labs., Albuquerque, NM, USA; Central Electricity Generating Board, Berkeley, UK. Berkeley Nuclear Labs.; UKAEA Atomic Energy Research Establishment, Harwell. Energy Technology Div.; UKAEA Atomic Energy Research Establishment, Harwell. Chemistry Div.; Tokyo Univ., Japan. Faculty of Engineering). Jan 1986. H.M. Stationery Office, London, price Pound 16.00. (CONF-8509169—).

From Specialist workshop on iodine chemistry in reactor safety organization for economic cooperation and development; Harwell, UK (9 Sep 1985).

It has been claimed that the chemical form of iodine released under severe accident conditions is cesium iodide. However, papers presented in this session of the workshop suggest that through reactions with boric acid or radiolytic effects more volatile iodine species could be released with important implications in reactor safety assessment. It should not be assumed that trace levels of oxygen would not be present following a severe PWR accident and experiments involving CSI reactions where oxygen is removed are probably irrelevant to real conditions. Previous experiments have been concerned with aqueous phase reactions but it is necessary to perform experiments in the gas phase.

8876 (AERE-R—11974, pp 361-365) **General discussion (of all topics from the meeting).** Potter, P.E.; Burns, W.G.; Sellers, R.M. (UKAEA Atomic Energy Research Establishment, Harwell. Chemistry Div.; Central Electricity Generating Board, Berkeley, UK. Berkeley Nuclear Labs.). Jan 1986. H.M. Stationery Office, London, price Pound 16.00. (CONF-8509169—).

From Specialist workshop on iodine chemistry in reactor safety organization for economic cooperation and development; Harwell, UK (9 Sep 1985).

In the general discussion at the conclusion of the iodine workshop, Harwell, September 1985, the importance of the study of all aspects of iodine chemistry was emphasised. The necessity of establishing a data-base for radiolysis, hydrolysis and oxidation rates was proposed. Studies of iodine chemistry will aid the prediction of the magnitude of possible volatile iodine releases in design basis and severe accidents in PWRs. The management and control of such situations was discussed.

8877 (BMU—1987-159) **Mitigation of flamable hydrogen mixtures under accident conditions in LWR's using metallic foils as catalysts.** Chakraborty, A.K.; Klatt, K.H.; Konrad, R.D.; Wenzl, H. (Bundesministerium fuer Umwelt, Naturschutz und Reaktorsicherheit, Bonn (Germany, F.R.); Gesellschaft fuer Reaktorsicherheit m.b.H. (GRS), Garching (Germany, F.R.); Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.)). Apr 1987. 83p. (In German). (GRS-A—1335). GRM Werbeberatung - Werbemittlung - PR, Eggenstein-Leopoldshafen, Germany, F.R.

Schriftenreihe Reaktorsicherheit und Strahlenschutz. Ergebnisberichte, Untersuchungen, Studien, Gutachten.

In order to remove hydrogen from flammable hydrogen-air-mixtures, numerous experiments were carried out with metallic Al sandwich foils. Here the parameters like temperatures, partial pressures of the gases and their compositions were varied. The catalytic action of the foils could be reproduced till to the spalling of the metallic films (Pd). At lower temperatures the catalytic action is slighlty retarded. As the removal of hydrogen by catalytic action is connected with temperature increase, so the reaction accelerates later even though the temperature at the beginning was low. Gas component like CO/sub 2/ does not influence the kinetics of reaction. While CO slows the onset of the reaction, it causes a slight increase of the temperature of the foils. Experiments carried out under anticipated gas compositions at various temperatures of the late phase of core melt accident show that the foils are capable of removing hydrogen within a short time by catalytic reaction. Tests have showed that the covering of water soluble aerosols on the foils has no influence on the catalytic capacity of the foils. Several

devices with the foils have been proposed for local and general use within the containment. With thoughtful conception, the convection and the mass flow during an accident can be improved considerably. Several Pd alloys with application in as rolled forms have been developed. The catalytic capabilities of the alloys in the presence of catalytic poisons are so satisfactory, that they can be applied in the form of plates or foils without any additional vacuum depositions.

8878 **(BNL-NUREG—40326) Lessons learned from a review of post-accident sampling systems, high range effluent monitors and high concentration particulate iodine samplers.** Hull, A.P.; Knox, W.H.; White, J.R. (Brookhaven National Lab., Upton, NY (USA); Knox Consultants, Inc., Dunwoody, GA (USA); Nuclear Regulatory Commission, King of Prussia, PA (USA). Region I). 1987. Contract AC02-76CH00016. 16p. (CONF-871202—3). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88001554/JAW.

From 21. mid-year meeting of the Health Physics Society: power reactor health physics; Miami Beach, FL, USA (12 Dec 1987).

Post-accident sampling systems (PASS), high range gaseous effluent monitors and sampling systems for particulates and iodine in high concentrations have been reviewed at twenty-one licensee sites in Region I of the US Nuclear Regulatory Commission which includes fifteen BWR's and fourteen PWR's. Although most of the installed PASS met the criteria, the highest operational readiness was found in on-line systems that were also used for routine sampling and analysis. The detectors used in the gaseous effluent monitors included external ion chambers, GM tubes, organic scintillators and Cd-Te solid state crystals. Although all were found acceptable, each had its own inherent limitations in the conversion of detector output to the time varying concentration of a post-accident mixture of noble gases. None of the installed particulate and iodine samplers fully met all of the criteria. Their principal limitations included a lack of documentation showing that they could obtain a representative sample and that many of them would collect of an excessive amount of activity at the design criteria. 10 refs., 4 figs., 5 tabs.

8879 **(CONF-870812—30) Gap and impact of LMR [Liquid Metal Reactor] piping systems and reactor components.** Ma, D.C.; Gvildys, J.; Chang, Y.W. (Argonne National Lab., IL (USA)). 1987. Contract W-31109-ENG-38. 21p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88003101/JAW.

From 9. SMIRT: international conference on structural mechanics in reactor technology; Lausanne, Switzerland (17 Aug 1987).

Because of high operation temperature, the LMR (Liquid Metal Reactor) plant is characterized by the thin-walled piping and components. Gaps are often present to allow free thermal expansion during normal plant operation. Under dynamic loadings, such as seismic excitation, if the relative displacement between the components exceeds the gap distance, impacts will occur. Since the components and piping become brittle over their design lifetime, impact is of important concern for it may lead to fractures of components and other serious effects. This paper deals with gap and impact problems in the LMR reactor components and piping systems. Emphasis is on the impacts due to seismic motion. Eight sections are contained in this paper. The gap and impact problems in LMR piping systems are described and a parametric study is performed on the effects of gap-induced support nonlinearity on the dynamics characteristics of the LMR piping systems. Gap and impact problems in the LMR reactor components are identified and their mathematical models are illustrated, and the gap and impact problems in the seismic reactor scram are discussed. The mathematical treatments of various impact models are also described. The uncertainties in the current seismic impact analyses of LMR components and structures are presented. An impact test on a 1/10-scale LMR thermal liner is described. The test results indicated that several clusters of natural modes can be excited by the impact force. The frequency content of the excited modes depends on the duration of the impact force; the shorter the duration, the higher the frequency content.

8880 (CONF-871018—Vol.2, pp IV.270-IV.284) **Abrasive water jet cutting technique for biological shield concrete dismantlement.** Konno, T.; Narazaki, T.; Yokota, M.; Yoshida, H.; Miura, M.; Miyazaki, Y. (Japan Atomic Energy Research Institute, Ibaraki-ken). 1987. NTIS, PC A99/MF A01. Order Number DE87012822/JAW.

From International decommissioning symposium; Pittsburgh, PA, USA (4 Oct 1987).

The Japan Atomic Energy Research Institute (JAERI) is developing the abrasive-water jet cutting system to be applied to dismantling the biological shield walls of the JPDR as a part of the reactor dismantling technology development project. This is a total system for dismantling highly activated concrete. The concrete biological shield wall is cut into blocks by driving the abrasive-water jet nozzle, which is operated with a remote, automated control system. In this system, the concrete blocks are removed to a container, while the slurry and dust/mist which are generated during cutting are collected and treated, both automatically. It is a very practical method and will quite probably by used for actual dismantling of commercial power reactors in the future because it can minimize workers' exposure to radioactivity during dismantling, contributes to preventing diffusion of radiation, and reduces the volume of contaminated secondary waste.

8881 (CONF-871018—Vol.2, pp VI.121-VI.136) **Experience of partial dismantling and large component removal of light water reactors.** Dubourg, M. (Paris la Defense, France). 1987. NTIS, PC A99/MF A01. Order Number DE87012822/JAW.

From International decommissioning symposium; Pittsburgh, PA, USA (4 Oct 1987).

Not any of the French PWR reactors need to be decommissioned before the next decade or early 2000. However, feasibility studies of decommissioning have been undertaken and several dismantling scenarios have been considered including the dismantling of four PWR units and the on-site entombment of the active components into a reactor building for interim disposal. In addition to theoretical evaluation of radwaste volume and activity, several operations of partial dismantling of active components and decontamination activities have been conducted in view of dismantling for both PWR and BWR units. By analyzing the concept of both 900 and 1300 MWe PWR's, it appears that the design improvements taken into account for reducing occupational dose exposure of maintenance personnel and the development of automated tools for performing maintenance and repairs of major components, contribute to facilitate future dismantling and decommissioning operations.

8882 **(CONF-871101—75) Comparison of the SASSYS/SAS4A radial core expansion reactivity feedback model and the empirical correlation for FFTF.** Wigeland, R.A. (Argonne National Lab., IL (USA)). 1987. Contract W-31109-ENG-38. 5p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE88003036/JAW.

From Joint meeting of the American Nuclear Society and the Atomic Industrial Forum; Los Angeles, CA, USA (15 Nov 1987).

The present emphasis on inherent safety for LMR designs has resulted in a need to represent the various reactivity feedback mechanisms as accurately as possible. The dominant negative reactivity feedback has been found to result from radial expansion of the core for most postulated ATWS events. For this reason, a more detailed model for calculating the reactivity feedback from radial core expansion has been recently developed for use with the SASSYS/SAS4A Code System. The purpose of this summary is to present an extension to the model so that it is more suitable for handling a core restraint design as used in FFTF, and to compare the SASSYS/SAS4A results using this model to the empirical correlation presently being used to account for radial core expansion reactivity feedback to FFTF.

8883 **(CONF-871236—1) Kinetics of fission product release prior to fuel slumping.** Rest, J. (Argonne National Lab., IL (USA)). Oct 1987. Contract W-31109-ENG-38. 66p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE88002899/JAW.

From Workshop on chemical processes and producers in severe reactor accidents; Captiva Island, FL, USA (9 Dec 1987).

This paper describes the primary physical/chemical models recently incorporated into a mechanistic code (FASTGRASS) for the estimation of fission product release from fuel, and compares predicted results with test data. The theory of noble gas behavior is discussed in relation to its effect on the release behavior of I, Cs, Te, Ba, and Sr. The behavior of these fission products in the presence of fuel liquefaction/dissolution and oxidation grain-growth phenomena is presented, as is the chemistry of Sr, Ba, I, and Cs. Comparison of code predictions with data indicates the following trends. Fission product release behavior from solid strongly depends on fuel microstructure, irradiation history, time at temperature, and internal fuel rod chemistry. Fuel liquefaction/dissolution, fracturing, and oxidation also exert a pronounced effect on release during fuel rod degradation. For very low burnup fuel appreciable fission product retention in previously liquefied fuel can occur due to the low concentration of fission products, and the limited growth of bubbles in the liquefied material. 24 refs., 13 figs., 9 tabs.

8884 **(CONF-8705224—1) Mechanistic model for void distribution in flashing flow.** Riznic, J.; Ishii, M.; Afgan, N. (Institut za Nuklearne Nauke Boris Kidric, Belgrade (Yugoslavia); Argonne National Lab., IL (USA)). 1987. Contract W-31109-ENG-38. 19p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88002948/JAW.

From International center for heat and mass transfer seminar; Dubrovnik, Yugoslavia (24 May 1987).

A problem of discharging of an initially subcooled liquid from a high pressure condition into a low pressure environment is quite important in several industrial systems such as nuclear reactors and chemical reactors. A new model for the flashing process is proposed here based on the wall nucleation theory, bubble growth model and drift-flux bubble transport model. In order to calculate the bubble number density, the bubble number transport equation with a distributed source from the wall nucleation sites is used. The model predictions in terms of the void fraction are compared to Moby Dick and BNL experimental data. It shows that satisfactory agreements could be obtained from the present model without any floating parameter to be adjusted with data. This result indicates that, at least for the experimental conditions considered here, the mechanistic prediction of the flashing phenomenon is possible based on the present wall nucleation based model. 43 refs., 4 figs.

8885 **(CONF-8709192—1) A simplified analysis of uncertainty propagation in inherently controlled ATWS events.** Wade, D.C. (Argonne National Lab., IL (USA)). 1987. Contract W-31109-ENG-38. 11p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88002938/JAW.

From Annual NEACRP meeting; Helsinki, Finland (14 Sep 1987).

The quasi static approach can be used to provide useful insight concerning the propagation of uncertainties in the inherent response to ATWS events. At issue is how uncertainties in the reactivity coefficients and in the thermal-hydraulics and materials properties propagate to yield uncertainties in the asymptotic temperatures attained upon inherent shutdown. The basic notion to be quantified is that many of the same physical phenomena contribute to both the reactivity increase of power reduction and the reactivity decrease of core temperature rise. Since these reactivities cancel by definition, a good deal of uncertainty cancellation must also occur of necessity. For example, if the Doppler coefficient is overpredicted, too large a positive reactivity insertion is predicted upon power reduction and collapse of the ΔT across the fuel pin. However, too large a negative reactivity is also predicted upon the compensating increase in the isothermal core average temperature - which includes the fuel Doppler effect.

8886 **(CONF-8709192—3) A technique for computing bowing reactivity feedback in LMFBR's.** Finck, P.J. (Argonne National Lab., IL (USA)). 1987. Contract W-31109-ENG-38. 6p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88002941/JAW.

From Annual NEACRP meeting; Helsinki, Finland (14 Sep 1987).

During normal or accidental transients occurring in a LMFBR core, the assemblies and their support structure are subjected to important thermal gradients which induce differential thermal expansions of the walls of the hexcans and differential displacement of the assembly support structure. These displacements, combined with the creep and swelling of structural materials, remain quite small, but the resulting reactivity changes constitute a significant component of the reactivity feedback coefficients used in safety analyses. It would be prohibitive to compute the reactivity changes due to all transients. Thus, the usual practice is to generate reactivity gradient tables. The purpose of the work presented here is twofold: develop and validate an efficient and accurate scheme for computing these reactivity tables; and to qualify this scheme.

8887 **(CONF-8710111—8) Evaluation of advanced and current leak detection system.** Kupperman, D.S. (Argonne National Lab., IL (USA)). 1987. Contract W-31109-ENG-38. 6p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE88002695/JAW.

From 15. water reactor safety information meeting; Gaithersburg, MD, USA (26 Oct 1987).

US Nuclear Regulatory Commission Guide 1.45 recommends the use of at least three different detection methods in reactors to detect leakage. Monitoring of both sump-flow and airborne particulate radioactivity is mandatory. A third method can involve either monitoring of condensate flow rate from air coolers or monitoring of airborne gaseous radioactivity. Although the methods currently used for leak detection reflect the state of the art, other techniques may be developed and used. Since the recommendations of Regulatory Guide 1.45 are not mandatory, Licensee Event Report Compilations have been reviewed to help establish actual capabilities for leak detection. The review of reports which had previously covered the period June 1985 to August 1986, has been extended. The total number of events of significance is now 83. These reports have provided documented, sometimes detailed summaries of reactor leaks.

8888 **(EPRI-NP—1850-CCM-Vol.5) RETRAN-02: A program for transient thermal-hydraulic analysis of complex fluid flow systems: Volume 5, Modeling guidelines: Computer code manual.** Harrison, J.F.; Farman, R.F.; Peterson, C.E.; Jensen, P.J. (EI Services, Idaho Falls, ID (USA)). Nov 1987. 490p. Research Reports Center, Box 50490, Palo Alto, CA 94303; GPO Dep. Order Number TI88920091/JAW.

RETRAN is a computer code designed to perform overall system response analyses of reactor power plants. The RETRAN code uses plant geometry, initial thermal-hydraulic states, component data, control function descriptions, and physics data as input to calculate the overall plant system thermal-hydraulic response during a transient. Where additional detail is required, the overall system response calculated by RETRAN can be used as a boundary condition for the detailed analysis.

8889 **(INIS-mf—10781) Improvement and verification of WAVCO for the analysis of gas distribution in the containment. Final report.** Fischer, M.; Reineke, H.H. (Kraftwerk Union A.G., Erlangen, Germany, F.R.. Fossile Energietraeger - Konventionelle Entsorgung; Institut fuer Verfahrenstechnische Anlagen, Seelze, Germany, F.R.). (Kraftwerk Union A.G., Erlangen (Germany, F.R.); Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). 1987. 156p. (In German). NTIS (US Sales Only), PC A08/MF A01. Order Number DE88751512/JAW.

Under the scope of this study, the KWU-multi-zone computer program WAVCO (Hydrogen-Distribution in the Containment), for use in hypothetical core melt accident situations has been upgraded and verified against distribution experiments performed earlier. Analyses of gas-distribution in the PWR-containment after a postulated, hypothetical core melt accident, confirm current assumptions of an almost homogeneous distribution of burnable gas. Based on the present state-of-the-art concerning gas release, a maximum H/sub 2//CO concentration of 12% vol. under low pressure conditions was calculated. Under high pressure conditions there was no evidence of ignitable gas mixture built-up, despite an approx. 8% vol. local H/sub 2/-enrichment. With 34 refs., 14 tabs., 70 figs..

8890 **(INIS-mf—10783) Investigation into fission product exhalation from spent fuel in the presence of Zircaloy and oxygen. Final report.** Kaspar, G.; Haas, W.; Bleier, A. (Kraftwerk Union A.G., Erlangen (Germany, F.R.). Brennelement-Technologie; Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). 1987. 75p. (In German). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88751514/JAW.

The modelling of the transient behaviour of fuel requires the investigation of iodine and cesium release under transient conditions. The test program performed covers a temperature range from 900 to 1750degC. The main item was the investigation of the release under oxidizing conditions and at presence of Zircaloy. The reactions occurring thereby cause a strong increase of iodine and cesium release. The influence of the temperature on the release is characterized by a change of the activation energy within the temperature regime of the experimental program. With 21 refs., 2 tabs., 39 figs..

8891 **(INIS-mf—10787) PKL-tests, test series IIB (end of blowdown). Vol. 1. Description of test facility. Final report.** Kremin, H.; Schmidt, H.; Gueneysu, R. (Kraftwerk Union A.G., Erlangen (Germany, F.R.); Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). 1986. 106p. (In German). NTIS (US Sales Only), PC A06/MF A01. Order Number DE88751517/JAW.

Within the scope R+D-task 1500 287/AO , the 1300 MWe PWR systems behaviour has been investigated in the PKL test facility under LOCA conditions (large breaks) during end-of-blowdown (EOB), as well as during refill- and reflood phases. In order to combine the EOB-phase (starting at 26 bar) with the refill- and reflood phase, the facility was modified and upgrading measures were taken to improve measurement techniques. This report gives a detailed description of the PKL-test facility, its auxiliary systems and power supply as of January 1985, test series PKL IIB. With 5 refs., 57 figs.

8892 **(IWGFPT—27) Water reactor fuel behaviour and fission products release in off-normal and accident conditions.** (International Atomic Energy Agency, Vienna (Austria). International Working Group on Water Reactor Fuel Performance and Technology). 1987. 259p. (CONF-8611109—). NTIS (US Sales Only), PC A12/MF A01. Order Number DE88900151/JAW.

From IAEA technical committee meeting on water reactor fuel behaviour and fission products release in off-normal and accident conditions; Vienna, Austria (10 Nov 1986).

This report is presented in four sections with subject content as follows: core materials, physico-chemical properties and interactions under off-normal conditions; core materials deformation and coolability under accident conditions; fission product release, mechanisms modelling and code qualification; and power plant experience. Nineteen reports have been cataloged separately. (FI)

8893 (IWGFPT—27, pp 44-53) **Relocation of Zircaloy-clad uranium dioxide under severe accident conditions.** Cook, B.A. (EG & G Idaho, Idaho Falls). 1987. NTIS (US Sales Only), PC A12/MF A01. Order Number DE88900151/JAW. (CONF-8611109—).

From IAEA technical committee meeting on water reactor fuel behaviour and fission products release in off-normal and accident conditions; Vienna, Austria (10 Nov 1986).

The mechanisms affecting the relocation of Zircaloy-clad UO_2 fuel rods during severe accidents in pressurized water reactors are discussed. Results from two integral in-pile tests and from the damaged Three Mile Island Unit-2 reactor core are presented. The thermal hydraulic conditions that influence fuel relocation are identified and chemical interactions between the fuel and the control rod material are addressed as they relate to material relocation.

8894 (IWGFPT—27, pp 54-66) **PWR severe fuel damage phenomena: UK contribution to the fuel pin liquefaction modelling.** Lillington, J.N.; Lyons, A.J. (United Kingdom Atomic Energy Agency, Winfrith, England). 1987. NTIS (US Sales Only), PC A12/MF A01. Order Number DE88900151/JAW. (CONF-8611109—).

From IAEA technical committee meeting on water reactor fuel behaviour and fission products release in off-normal and accident conditions; Vienna, Austria (10 Nov 1986).

Under extreme loss of cooling conditions for an extended period, a reactor core will heat up due to nuclear or chemical heating and this may lead to core degradation and a serious accident. This paper will address the issues relevant to a PWR and consider the completeness of the data-base and models used in fuel damage codes with particular reference to SCDAP and MELPROG. These codes have been obtained via agreements with the USNRC and the UK is contributing to their development and application. The progress of a PWR severe accident is strongly influenced by the Zircaloy/steam and Zircaloy/fuel reactions. The former produces significant additional heat and hydrogen. There may also be an additional reaction between the Zircaloy and control rod materials (silver and indium). The latter leads to fuel erosion and subsequent relocation of Zr-U-O eutectic material to the lower vessel regions. The paper concentrates on the latter related mechanisms and models.

8895 (IWGFPT—27, pp 66-75) **Chemical interaction of Zircaloy tubing with UO_2 fuel and steam at temperatures between 1000°C and 2000°C: Verification of the PECLOX code.** Garcia, E.A.; Hofmann, P.; Neitzel, H.J. (Comision Nacional de Energia Atomica, Buenos, Aires, Argentina; Kernforschungszentrum Karlsruhe GmbH, Federal Republic of Germany). 1987. NTIS (US Sales Only), PC A12/MF A01. Order Number DE88900151/JAW. (CONF-8611109—).

From IAEA technical committee meeting on water reactor fuel behaviour and fission products release in off-normal and accident conditions; Vienna, Austria (10 Nov 1986).

In a SFD (Severe Fuel Damage) accident the Zircaloy-4 (Zry) cladding material will interact with the UO_2-fuel on the internal cladding surface and with steam on the external cladding surface. These reactions result in the formation of ZrO_2, various oxygen-stabilized α-Zr(O) phases and a (U,Zr) alloy. The internal UO_2/Zry interaction can be considered as oxidation of Zry by reaction with a solid oxide (UO_2). The reaction becomes significant at temperatures above 1000°C, if a good solid contact between cladding and fuel exists. Two codes have been developed to describe the internal and external Zry cladding oxidation. One is the PECLOX code and the other one is the HITO code. Both of them use finite difference methods to solve the oxygen diffusion equation in the various reaction layers; the first one is in the explicit version and the second one in the implicit version. In this work, experimental results of isothermal and temperature transients reaction experiments are used to test the PECLOX code.

8896 (IWGFPT—27, pp 76-88) **A review of significant safety research results on Zircaloy fuel cladding deformation and coolability of deformed rod bundles in a LOCA.** Erbacher, F.J. (Kernforschungszentrum Karlsruhe GmbH, Federal Republic of Germany). 1987. NTIS (US Sales Only), PC A12/MF A01. Order Number DE88900151/JAW. (CONF-8611109—).

From IAEA technical committee meeting on water reactor fuel behaviour and fission products release in off-normal and accident conditions; Vienna, Austria (10 Nov 1986).

The paper summarizes the dominant effects which finally ensure the core coolability of a pressurized water reactor (PWR) in a loss-of-coolant accident (LOCA). The results presented relate mainly to research work performed at Karlsruhe Nuclear Research Center (KfK) on the deformation mechanisms of Zircaloy cladding tubes, the influence of thermal-hydraulics on cladding deformation and flow blockage and the coolability of deformed rod bundles.

8897 (IWGFPT—27, pp 89-98) **Influence of azimuthal and axial non-uniformities of fuel-clad straining on WWER type assembly: Flow area blockage under accident conditions.** Solyany, V.I.; Andreeva-Andrievskaya, L.N.; Bibilashvili, Yu.K.; Salatov, A.V.; Tonkov, V.Yu. (All-Union Scientific Research Institute for Inorganic Materials, Moscow, USSR). 1987. NTIS (US Sales Only), PC A12/MF A01. Order Number DE88900151/JAW. (CONF-8611109—).

From IAEA technical committee meeting on water reactor fuel behaviour and fission products release in off-normal and accident conditions; Vienna, Austria (10 Nov 1986).

The efficiency of provisions against accident situations at WWER NPP due to the depressurization of the primary circuit is in many respects dictated by the conditions of filling in the core from the system of emergency cooling. Therefore, it is important that the fuel clad ballooning in the process of an accident should not significantly block the flow area of fuel assemblies or critically impair their cooling. This paper discusses the influence of fuel clad straining on the blockage in WWER type assemblies and is a further evolution of investigations in this direction.

8898 (IWGFPT—27, pp 98-108) **Characteristics of corrosion behaviour of Zr1%Nb WWER fuel claddings within 700-1000°C on long term exposures.** Solyany, V.I.; Bibilashvili, Yu.K.; Dranenko, V.V.; Izrailevskii, L.B.; Levin, A.Ya.; Morozov, A.A. (All-Union Scientific Research Institute for Inorganic Materials, Moscow, USSR; All-Union Thermo-Technical Institute, Moscow, USSR). 1987. NTIS (US Sales Only), PC A12/MF A01. Order Number DE88900151/JAW. (CONF-8611109—).

From IAEA technical committee meeting on water reactor fuel behaviour and fission products release in off-normal and accident conditions; Vienna, Austria (10 Nov 1986).

This paper describes some results of corrosion tests carried out to investigate corrosive interaction between Zr-1%Nb cladding and water steam in accident conditions, in the temperature range of 700 to 1500°C. The curves of weight gain vs. time showed multiple transitions. The influence of temperature changes on the mode and kinetics of oxidation is being analyzed.

8899 (IWGFPT—27, pp 109-132) **Research of LWR fuel rod behaviour under accident conditions.** Pazdera, F.; Valach, M.; Vrtilkova, V. (Nuclear Research Institute, Rez, Czechoslovakia; Insitute for Nuclear Fuels, Zbraslav, Czechoslovakia). 1987. NTIS (US Sales Only), PC A12/MF A01. Order Number DE88900151/JAW. (CONF-8611109—).

From IAEA technical committee meeting on water reactor fuel behaviour and fission products release in off-normal and accident conditions; Vienna, Austria (10 Nov 1986).

Recent results of theoretical and experimental research on light water reactor fuel rod behavior under accident conditions are presented. Mechanical equation of state for Zr1Nb cladding alloy is proposed. The equation is compared with 19 tensile tests and 81 creep tests in the strain rate range 10^{-6} to 10^{-1} s^{-1} and temperature range 600 to 900°C. Comparison with experiments confirms both adequate description of steady state and transient loading. Verification of computer code FRAS for light water reactor fuel rod behavior modeling under accident conditions was performed. Several examples are presented: comparison with published experiments on NSRR reactor, calculation of WWER 440 fuel rod behavior under LOCA conditions with and without subchannel thermohydraulics. A two dimensional code describing cladding deformation in r-z geometry was developed. Various deformation shapes are calculated for burst tests performed at constant temperature.

8900 (IWGFPT—27, pp 133-140) **Analysis of fission product release during a simulated severe fuel damage accident: The HEVA programme.** Mathiot, A.; Le Marois, G.; Warlop, R. (CEA, Institut de recherche technologique et de developpement industriel, Grenoble, France). 1987. NTIS (US Sales Only), PC A12/MF A01. Order Number DE88900151/JAW. (CONF-8611109—).

From IAEA technical committee meeting on water reactor fuel behaviour and fission products release in off-normal and accident conditions; Vienna, Austria (10 Nov 1986).

The HEVA experiments are part of the CEA.IPSN experimental program devoted to investigating fuel and fission product behavior during severe PWR accidents. The main objectives of the program are as follows: to simulate a defined accident sequence on a section of irradiated pin; to study qualitatively and quantitatively the kinetics of fission product release during the sequence; and to determine the physical and chemical characteristics of the species released. The fission products released by the fuel are analyzed by means of on-line gamma-spectrometry. Aerosols are sampled and sorted by means of a cascade impactor, located directly above the sample. The condensed water is analyzed by means of two specific electrodes (for H^+ and I^- ions). The experimental program takes into account a parametric study of maximum fuel temperature and impactor temperature. Some samples were irradiated in the SILOE reactor just before the test in order to be able to monitor short-lived fission products (especially iodines).

8901 (IWGFPT—27, pp 140-162) **Analysis of fission gas release from UO_2 fuel during power transients by FEMAXI-IV code.** Nakajima, T.; Saito, H. (Japan Atomic Energy Research Institute, Ibaraki-ken; Century Research Center Corp., Tokyo, Japan). 1987. NTIS (US Sales Only), PC A12/MF A01. Order Number DE88900151/JAW. (CONF-8611109—).

From IAEA technical committee meeting on water reactor fuel behaviour and fission products release in off-normal and accident conditions; Vienna, Austria (10 Nov 1986).

FEMAXI-IV is a computer code to analyze the thermal and mechanical behavior of a fuel rod during steady-state and transient conditions. In FEMAXI-IV, the time-dependent models are used for heat conduction, fission gas release, and mixing of the released gas with the plenum gas. The fission gas release model, involved in FEMAXI-IV, takes into account the following mechanisms: diffusion of gas atoms to the grain boundary considering the effect of trapping at intragranular bubbles, sweeping of gas atoms by grain growth, resolution of gas atoms into the grain interior from grain boundary bubbles, and fission gas release due to bubble interconnection. The release of fission gas during transient condition is accelerated by the grain boundary sweeping and the rapid, long-range interconnection of porosity. On the other hand the transient release of fission gas to the gap volume causes a contamination of filler gas in the gap and hence high fuel temperature until the released gas is diluted with the filler gas in the plenum. Such fission gas behavior during transient condition was analyzed by FEMAXI-IV code and calculations were compared with the fission gas release data obtained in the power ramp experiments. This paper summarizes the models involved in FEMAXI-IV and the results of calculations on the experimental data.

8902 (IWGFPT—27, pp 163-183) **Analysis of the fission product behavior under normal and off-normal reactor conditions.** Coquerelle, M.; Ronchi, C.; Sakellaridis, J.; van de Laar, J. (Commission of the European Communities, Karlsruhe, Federal Republic of Germany). 1987. NTIS (US Sales Only), PC A12/MF A01. Order Number DE88900151/JAW. (CONF-8611109—).

From IAEA technical committee meeting on water reactor fuel behaviour and fission products release in off-normal and accident conditions; Vienna, Austria (10 Nov 1986).

The paper presents the results of a thorough analysis of the release mechanisms in water reactor fuels. Based on a multiannual research project on fuel behavior carried out at JRC Karlsruhe, models have been developed and integrated in the fuel performance codes FUTURE and MITRA. In these codes the release processes are described within a comprehensive structural scenario and compared with the fuel swelling and restructuring features observed during steady-state and transient irradiation conditions. The problems related to the formulation of the various mechanisms are briefly discussed in sections 1 and 2, where recently published results on this subject are referred to. Examples of applications of the model analysis to laboratory and in-pile release experiments are presented. In particular, a calculation of the D-COM blind case exercise proposed by International Atomic Energy Agency (IAEA) was performed. The results of the release analysis for long-lived fission gas are very satisfactory, while those for short-lived fission products still need to be improved since the fundamental data are scarce and imprecise. Finally, preliminary results on release of particulate and less volatile fission products are reported.

8903 (IWGFPT—27, pp 196-210) **Fuel performance and fission product release during loss of coolant and severe fuel damage accidents.** Sills, H.E.; Iglesias, F.C.; Fehrenbach, P.J.; Wood, J.C. (Atomic Energy of Canada Ltd., Chalk River). 1987. NTIS (US Sales Only), PC A12/MF A01. Order Number DE88900151/JAW. (CONF-8611109—).

From IAEA technical committee meeting on water reactor fuel behaviour and fission products release in off-normal and accident conditions; Vienna, Austria (10 Nov 1986).

This paper describes the results from out-pile tests to determine the reaction mechanics and kinetics controlling the oxidation of UO_2 at temperatures up to 1600°C. Our studies included the identification of reaction products formed as a function of temperature and oxidizing environment. Factors affecting the oxidative release of fission products from UO_2 and their subsequent transport and deposition were oxide stoichiometry, oxidation rate, grain growth, fragmentation, and the presence of Zircaloy. All-effects, in-pile tests will provide verification of fission product release at sheath temperatures from 1200 to 2500°C. The data we collect will describe the transport and deposition of fission products in the primary heat transport system, fuel element deformation, fuel/clad interaction and postdefect behavior. Additionally, we will accrue data supporting decontamination technique following a severe fuel damage accident. Results of the LOCA test program are presented as well as the test sequence for the Blowdown Test Facility. The CANSIM suite of fuel performance models has been verified against extensive databases of in-pile results for normal and off-normal behavior respectively. CANSIM integrates fuel codes with a transient, subchannel code to model the strong interaction between fuel assembly deformation and channel thermalhydraulics and thus simulate fuel element failure, fission product activity release and coolant flow blockage.

8904 (IWGFPT—27, pp 211-217) **The behavior of fuel and fission products in manoeuvring the power of the water cooled reactors.** Luzanova, L.M.; Miglo, V.N.; Slavyagin, P.D. (State Committee on the Utilization of Atomic Energy, Moscow, USSR). 1987. NTIS (US Sales Only), PC A12/MF A01. Order Number DE88900151/JAW. (CONF-8611109—).

From IAEA technical committee meeting on water reactor fuel behaviour and fission products release in off-normal and accident conditions; Vienna, Austria (10 Nov 1986).

Problems relating to investigation of dioxide fuel behavior and variation of fission product activity in power maneuvering in the VVER-type water-cooled reactors are considered. It is pointed out that at loads which do not result in onset of a zone of structural changes the behavior of fuel and that of fission products in the fuel-cladding gap and in the primary coolant under the stationary and transient conditions are determined only by the fuel-cladding interactions. At any power variations the fuel is not subject to structural changes and no excess release of fission products from the fuel occurs. In the presence of developed zones of structural changes in failed fuel elements release of radioactive fission products to the primary coolant is determined only by the thermal regime in the zone of structural changes and is practically independent of the degree of the fuel-cladding interaction.

8905 (IWGFPT—27, pp 217-235) **Experience in monitoring the BWR fuel behaviour and fission product releases during off-normal conditions.** Joshi, N.B.; Srinivasan, V.S.; Nanjundeswaran, K. (Tarapur Atomic Power Station, India). 1987. NTIS (US Sales Only), PC A12/MF A01. Order Number DE88900151/JAW. (CONF-8611109—).

From IAEA technical committee meeting on water reactor fuel behaviour and fission products release in off-normal and accident conditions; Vienna, Austria (10 Nov 1986).

Tarapur Atomic Power Station has accumulated over 33 reactor years of operating experience in monitoring Boiling Water Reactor fuel behavior. The sudden and sharp increases in the fission product releases were experienced in the earlier years due to gross fuel failures caused by mechanical damage (lifting of certain core internals) or due to certain operating practices and transients. Data on fission product releases under such gross fuel failure conditions is presented and discussed with evaluation of the incident and corrective actions taken. An apparent correlation observed in incidents of fuel failures and certain operating system transients are discussed. Conventionally for the BWRs sum of six fission gas release rate measured at Steam Jet Air Ejectors is correlated with fission gas radiation monitor reading to work out alarm and trip settings - modifications are suggested to improve reliability and effectiveness in monitoring of fission gas release rates. Appropriate data for fission product deposition and characterization of coolant crud long lived fission products is also presented.

8906 (IWGFPT—27, pp 235-249) **The release of fission products from WWER-440 reactors under DBA conditions: Calculation methods and results for Zarnowiec NPP.** Strupczewski, A. (Institute of Atomic Energy, Swierk, Poland). 1987. NTIS (US Sales Only), PC A12/MF A01. Order Number DE88900151/JAW. (CONF-8611109—).

From IAEA technical committee meeting on water reactor fuel behaviour and fission products release in off-normal and accident conditions; Vienna, Austria (10 Nov 1986).

The paper presents the assumptions adopted in PSAR of Zarnowiec NPP for DBA fission product release and deals in more detail with the method of calculating gap release fraction for WWER-440 fuel elements. Typical temperature distribution fields are presented, showing the zones of structural changes in UO_2 fuel. The mechanism of fisaion product release are discussed and formulae for FP release are given for each zone, based mostly on the work of Soviet experts. The results of calculations performed for WWER-440 reactor in Zarnowiec NPP are presented and the gap release fraction is determined in function of fuel rod thermal loads. The migration of solid fission products is determined upon the basis of the work of Andriease joined to the mechanisms of FP release given in Luzanova and Slaviagin study. A discussion of the assumptions adopted in the present work is given and some simplifications pointed out. The justification of the assumption of limited fuel melting within the time of initial phase of the accident, when the pressure within the containment exceeds that of the atmosphere, is presented and its consequences for safety evaluation are considered. The results obtained are compared to those of contemporary fission product release studies for PWR reactors as assumed in Maximum Hypothetical Accident studies and Design Basis Accident studies.

8907 (IWGFPT—27, pp 250-257) **Importance of on-line primary coolant gamma activity monitoring for the assessment of the fuel condition during power reactor operation.** Rant, J.; Jencic, M.; Pregl, G.; Fink, K. (Jozef Stefan Institute, Ljubljana, Yugoslavia; Krsko Nuclear Power Plant, Yugoslavia). 1987. NTIS (US Sales Only), PC A12/MF A01. Order Number DE88900151/JAW. (CONF-8611109—).

From IAEA technical committee meeting on water reactor fuel behaviour and fission products release in off-normal and accident conditions; Vienna, Austria (10 Nov 1986).

In comparison to the well known fuel condition monitoring based on gamma activity measurements of grab samples of the primary coolant, the on-line coolant activity monitoring technique offers several benefits to be discussed in the paper. First, on-line coolant activity monitoring allows for near real-time qualitative or quantitative assessment of cladding defects, eliminating the time delay, personnel exposure and waste associated with the collection of grab samples. The possibility of monitoring the fuel condition during transients is also important for the plant operator. Due to the much greater number of activity measurements performed for a variety of nonvolatile, volatile and gaseous isotopes the accuracy of measured activities is improved. The prediction of defect characteristics such as type and size of the defect and its approximate location in the reactor core is also improved. For failure characterization the isotoic ratios $^{131}I/^{133}I$, $^{133}I/^{134}I$, $^{133}Xe/^{135}Xe$, $^{87}Kr/^{135}Xe$, $^{133}Xe/^{135}$, $^{134}Cs/^{137}Cs$ are important. An on-line fuel condition monitoring systems can be incorporated into the Plant Anomaly Detection System, providing important information to the plant operator on defect deterioration and thus assisting in plant operation and refueling strategy.

8908 (IWGFR—59, pp 205-228) **CRT code and results of some studies for power, reactivity and temperatures for LMFBR fuel rods under operational transients.** Om Pal Singh; Ponpondi, S.; Parikh, M.V. (Reactor Research Centre, Kalpakkam, India). Dec 1985. NTIS (US Sales Only), PC A11/MF A01. Order Number DE88700776/JAW. (CONF-8512144—).

From IWGFR specialists' meeting on LMFBR fuel rod behaviour under operational transients; Kalpakkam, India (3 Dec 1985).

The paper describes the details of the computer code, CRT, that has been developed to study the reactor power, reactivity and temperature transients in LMFBR fuel rods under operational tran-

sients. The code is based upon suitable modelling of reactor neutron kinetics, heat transfer phenomena and reactivity feedback effects coming from: axial/radial expansion of the fuel/clad/coolant; core boundary movement to axial and radial blankets; sodium entry/expulsion during the radial expansion of the core and apparent insertion/removal of control rods during core/reactor vessel expansion. Further, the results of some studies like, transient behaviour of reactor power and temperature distribution in fuel rods for reactor at low and high initial powers and for fresh and irradiated fuels; comparison of lumped and exact heat transfer models and evaluation of limiting reactivity addition rates for the lumped model to be adequate; influence of the gap conductance on the temperature distributions inside the fuel pellet and the clad and break up of reactivity coming from different feedback mechanisms and their dependence upon the heat transfer parameters are also presented. 7 refs, 14 figs, 3 tabs.

8909 **(KFK—4302) Thermohydraulic study of the reflooding phase after a loss of coolant accident in an advanced pressurized water reactor.** Cigarini, M. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Neutronenphysik und Reaktortechnik; Karlsruhe Univ. (T.H.) (Germany, F.R.). Fakultaet fuer Maschinenbau). Aug 1987. 155p. (In German). (EUR—10538d). NTIS (US Sales Only), PC A08/MF A01. Order Number DE88751530/JAW.

The aim of this work is to analyse the behaviour of some different Advanced Pressurized Water Reactor (APWR) designs during the reflooding phase following a large break (double ended) loss of coolant accident (LOCA). The FLUT code and its most important physical models and correlations will be shortly discussed. The major changes will be described addressing the reasons for their introduction. A special attention is given to the description of a newly developed droplet-model, which allows a better modelling of the progression of the quench front. In order to assess the updated correlations and models, many forced reflooding experiments were evaluated. The results of these post-test calculations will be shown. The calculations for two APWR designs will be then compared with that for the reference PWR, pointing out the most important differences.

8910 **(KFK—4319) IVA2 application: Three dimensional effects during APWR LOCA.** Kolev, N.I. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Neutronenphysik und Reaktortechnik). Sep 1987. 29p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88751532/JAW.

Using the IVA2/005 computer code three dimensional effects during a LOCA for a homogeneous APWR are simulated. The formation and transport of void and droplets in a reactor vessel of the KWU-1300 type, responsible for the three-dimensional cooling of the core are shown as functions of time and space. The results prove that it is important to perform a three-dimensional analysis rather than a one-dimensional one to predict more realistic temperature distributions of the fuel rods, especially for the strong three-dimensional multi-velocity fields considered in this study.

8911 **(LA-UR—87-3732) TRAC-PF1/MOD1 calculations and data comparisons for MIST [Multi-Loop Integral System Test] small-break loss-of-coolant accidents with scaled 10 cm² and 50 cm² breaks.** Steiner, J.L.; Siebe, D.A.; Boyack, B.E. (Los Alamos National Lab., NM (USA)). 1987. Contract W-7405-ENG-36. 27p. (CONF-8710111—10). NTIS, PC A03. Order Number DE88003175/JAW.

From 15. water reactor safety information meeting; Gaithersburg, MD, USA (26 Oct 1987).

Los Alamos National Laboratory is a participant in the Integral System Test (IST) program initiated in June 1983 for the purpose of providing integral system test data on specific issues/phenomena relevant to post-small-break loss-of-coolant accidents (SBLOCAs), loss of feedwater and other transients in Babcock & Wilcox (B & W) plant designs. The Multi-Loop Integral System Test (MIST) facility is the largest single component in the IST program. MIST is a 2 x 4 (2 hot legs and steam generators, 4 cold legs and reactor-coolant pumps) representation of lowered-loop reactor systems of the B & W design. It is a full-height, full-pressure facility with 1/817 power and volume scaling. Two other experimental facilities are included in the IST program: test loops at the University of Maryland, College Park, and at Stanford Research Institute. The objective of the IST tests is to generate high-quality experimental data to be used for assessing thermal-hydraulic safety computer codes. Efforts are underway at Los Alamos to assess TRAC-PF1/MOD1 against data from each of the IST facilities. Calculations and data comparisons for TRAC-PF1/MOD1 assessment have been completed for two transients run in the MIST facility. These are the MIST nominal test. Test 3109AA, a scaled 10 cm² SBLOCA and Test 320201, a scaled 50 cm² SBLOCA. Only MIST assessment results are presented in this paper.

8912 **(LA-UR—87-3733) Analysis results from the Los Alamos 2D/3D program.** Boyack, B.E.; Cappiello, M.W.; Harmony, S.C.; Shire, P.R.; Siebe, D.A. (Los Alamos National Lab., NM (USA)). 1987. Contract W-7405-ENG-36. 24p. (CONF-8710111—11). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88003174/JAW.

From 15. water reactor safety information meeting; Gaithersburg, MD, USA (26 Oct 1987).

Los Alamos National Laboratory is a participant in the 2D/3D program. Activities conducted at Los Alamos National Laboratory in support of 2D/3D program goals include analysis support of facility design, construction, and operation; provision of boundary and initial conditions for test-facility operations based on analysis of pressurized water reactors; performance of pretest and posttest predictions and analyses; and use of experimental results to validate and assess the single- and multi-dimensional, nonequilibrium features in the Transient Reactor Analysis Code (TRAC). During fiscal year 1987, Los Alamos conducted analytical assessment activities using data from the Slab Core Test Facility, The Cylindrical Core Test Facility, and the Upper Plenum Test Facility. Finally, Los Alamos continued work to provide TRAC improvements. In this paper, Los Alamos activities during fiscal year 1987 will be summarized; several significant accomplishments will be described in more detail to illustrate the work activities at Los Alamos.

8913 **(NUREG—0857-Suppl.12) Safety evaluation report related to the operation of Palo Verde Nuclear Generating Station, Units 1, 2, and 3 (Docket Nos. STN 50-528, STN 50-529, and STN 50-530).** (Nuclear Regulatory Commission, Washington, DC (USA). Div. of Reactor Projects III, IV, V and Special Projects). Nov 1987. 25p. NTIS, PC A03/MF A01 - GPO. Order Number TI88900119/JAW.

Supplement No. 12 to the Safety Evaluation Report for the application filed by Arizona Public Service Company, et al., for licenses to operate the Palo Verde Nuclear Generating Station, Units 1, 2 and 3 (Docket Nos. STN 50-528/529/530), located in Maricopa County, Arizona, has been prepared by the Office of Nuclear Reactor Regulation of the Nuclear Regulatory Commission. The purpose of this supplement is to update the Safety Evaluation Report by providing an evaluation of (1) additional information submitted by the licensee since Supplement No. 11 was issued and (2) other matters requiring staff review since Supplement No. 11 was issued, specifically those issues that required resolution before Unit 3 full power licensing.

8914 **(NUREG/CR—5011) Application of the adaptive-predictive controllers to plant safety surveillance utilizing on-line Plant Analyzer.** Fabic, S. (Dynatrek, Inc., Rockville, MD (USA)). Oct 1987. 139p. NTIS, PC A07/MF A01 - GPO. Order Number TI88900149/JAW.

The plant safety surveillance concept described in this report continuously provides information that is not accessible to measurements and which, in conjunction with the existing plant data, offers promise for a thorough understanding of the plant status and of the causes of upsets when they occur. The concept is based on using the Plant Analyzer Controller, which works in tandem with the Plant Analyzer, to control inputs to the Plant Analyzer so that its outputs continuously track the selected plant measurements. The basic premise is that, if the key plant measurements are being well reproduced (tracked) by the Plant Analyzer, the wealth of information which is being continuously computed (most of which cannot be measured), can be trusted and used to ascertain the plant status. Research results presented in this report show that the act of tracking immediately uncovers upset conditions which are, otherwise,

either not amenable to measurements or take a long time to diagnose using conventional methods. The Plant Analyzer (a systems safety code capable of running in real time on a plant computer), and the Plant Analyzer Controller, would be used "on-line", i.e., connected to the plant computer which provides information on plant measurements. Their outputs would be graphically displayed in a comprehensive and easily understood manner. The version of the Plant Analyzer Controller described in this report is based on the Adaptive-Predictive, digital control theory. 154 figs.

8915 **(NUREG/CR—5014) Parametric study of pipe whip analysis.** Chun, R.C.; Chuang, T.Y. (Lawrence Livermore National Lab., CA (USA)). Oct 1987. Contract W-7405-ENG-48. 46p. (UCRL—21177). NTIS, PC A03/MF A01 - GPO. Order Number TI88002680/JAW.

In the Energy Balance Analysis Model (Standard Review Plan (USNRC, 1981), Section 3.6.2, "Determination of Rupture Locations and Dynamic Effects Associated with the Postulated Rupture of Piping"), time dependence is not considered, and a constant blowdown thrust force is assumed. This force includes an amplification factor of 1.1 to account for potential effects of rebound. Many of the assumptions used in establishing the acceptance criteria, as stated in the Standard Review Plan, were based on engineering judgment and logic intended to assure upper bound design rather than on a mechanistic assessment of actual pipe rupture phenomena and their effects. As a result of the current practice an exceedingly conservative design may be introduced. This report represents a parametric study of the amplification factor to account for rebound effects in the Energy Balance Method. Of the 71 distinct cases we chose for our parametric study, the amplification factor of 1.1 seems sufficient except in five cases where the carbon steel pipes are small or have very small gaps between the pipes and the pipe whip restraints. We conclude that the amplification factor generally decreases as the parameters gap size, hinge-to-break distance and overhang increase. 9 refs., 13 figs., 8 tabs.

8916 **(PNL-SA—15133) Population dose considerations for decommissioning.** Kennedy, W.E. Jr.; Napier, B.A. (Pacific Northwest Lab., Richland, WA (USA)). Sep 1987. Contract AC06-76RL01830. 10p. (CONF-8709104—9). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88002085/JAW.

From ANS topical conference on population exposure from nuclear fuel cycle; Oak Ridge, TN, USA (15 Sep 1987).

Deontamination and decommissioning of retired nuclear power reactors is a necessary part of the nuclear fuel cycle. Inventories of radioactivity that will be encountered at large facilities (500 to 1200 MWe) during decommissioning operations include activated reactor components and contaminated piping, equipment, and building surfaces. Contaminated areas of the facility result from processing the primary coolant that contains activation products and fission products from the reactor core. The most abundant radionuclides in the inventory include ^{58}Co, ^{60}Co, ^{55}Fe, ^{59}Fe, ^{51}Cr, ^{59}Ni, and ^{63}Ni. Because of the relatively short physical half-lives of most activation products, the decision of when to decommission a reactor will directly influence the magnitude of the collective dose estimate. The total collective dose is the sum of exposures to several groups of individuals. These groups include decommissioning workers, transportation workers, the population along major transport routes, and the population living in the vicinity of the decommissioned reactor. Previous generic studies of the potential, collective radiationdoses from decommissioning have concluded that, barring accidents, the group receiving the most significant radiation doses will be the workers performing the decommissioning. This paper reviews generic population dose estimates for decommissioning reference boiling water and pressurized water reactors and provides extrapolated estimates of the total collective dose resulting from decommissioning the commerical nuclear reactors that have operated to date in the United States.

8917 **(TPR-NS—28-No.2) Nuclear Safety: Technical progress review, April-June 1987.** Silver, E.G. (ed.). (Oak Ridge National Lab., TN (USA)). Apr 1987. 146p. GPO $6.00. Order Number TI87004082/JAW.

Nuclear Safety is a review journal that covers significant developments in the field of nuclear safety. Its scope includes the analysis and control of hazards associated with nuclear energy, operations involving fissionable materials, and the products of nuclear fission and their effects on the environment. Primary emphasis is on safety in reactor design, construction, and operation; however, the safety aspects of the entire fuel cycle, including fuel fabrication, spent-fuel processing, nuclear waste disposal, handling of radioisotopes, and environmental effects of these operations, are also treated.

8918 **(TPR-NS—28-No.3) Nuclear Safety: Technical progress report, July-September 1987.** Silver, E.G. (ed.). (Oak Ridge National Lab., TN (USA)). Jul 1987. 152p. GPO $6.00. Order Number TI87007167/JAW.

The scope of this volume 28, No. 3 includes the analysis and control of hazards associated with nuclear energy, operations involving fissionable materials, and the products of nuclear fission and their effects on the environment. Primary emphasis is on safety in reactor design, construction, and operation; however, the safety aspects of the entire fuel cycle, including fuel fabrication, spent-fuel processing, nuclear waste disposal, handling of radioisotopes, and environmental effects of these operations, are also treated. Fourteen articles have been cataloged separately.

8919 **Assessment of the Chernobyl-4 accident localization system.** Donahue, M.; Gardner, R.; Vine, G. (Stone and Webster Engineering Corp.; Electric Power Research Institute). *Nuclear Safety;* **28**: No. 3, 297-311(Jul-Sep 1987).

This article summarizes the development, design, and operation of the Soviet accident localization system (ALS) and assesses the ALS design objectives and capabilities as applied to the Chernobyl Atomic Energy Station Unit 4 (Chernobyl-4) RBMK-1000 reactor. Because the purpose of the ALS is to provide a barrier against the uncontrolled release of radioactive material to the environment during certain reactor-cooling-system pipe breaks, the ALS has been described as the Soviet RBMK-1000 counterpart of commercial US light-water-reactor (LWR) containments. Assessment of the ALS capabilities from this perspective is included through a general description of the design objectives and typical features of commercial US LWR containments. A hypothetical RBMK-1000 containment incorporating typical design features of commercial US LWR containments is studied in a scoping assessment for performance under conditions estimated to be similar to those imposed by the Apr. 26, 1986, accident at Chernobyl-4. 3 refs., 7 figs.

8920 **1986 international meeting of nuclear reactor safety committees.** Moeller, D.W. (Nuclear Regulatory Commission, Washington, DC). *Nuclear Safety;* **28**: No. 3, 312-314(Jul-Sep 1987).

During the week of Oct. 20-23, 1986, nuclear power-plant safety representatives from the Federal Republic of Germany (FRG), France, Japan, and the US assembled to discuss subjects of mutual interest. The meeting, the first of its kind, was organized under the leadership and direction of David A. Ward, Chairman, Advisory Committee on Reactor Safeguards, US Nuclear Regulatory Commission (NRC), and held at the Wingspread Conference Center of the Johnson Foundation in Racine, Wis. Approximately 40 representatives of the several countries attended. Discussions were candid and provided the participants an opportunity to share thoughts and information on nuclear safety concerns and solutions.

8921 **Fourteenth Water Reactor Safety Information Meeting.** Silver, E.G. *Nuclear Safety;* **28**: No. 3, 315-330(Jul-Sep 1987).

This article provides a brief review of the Fourteenth Water Reactor Safety Information Meeting, one of an ongoing series of meetings sponsored by the Nuclear Regulatory Commission (NRC), Office of Nuclear Regulatory Research, to give the nuclear safety community up-to-date information on NRC-sponsored and other research in the nuclear safety area. 2 refs., 1 tab.

8922 **Technical note: Two important issues in reactor assessment.** Tong, L.S. (9733 Lookout Place, Gaithersburg, MD). *Nuclear Safety;* **28**: No. 3, 331-333(Jul-Sep 1987).

The two worst accidents in the world's nuclear industry occurred in a time span of seven years, namely, the accidents at Three Mile Island Nuclear Station Unit 2 (TMI-2) in 1979 and at Chernobyl in 1986. Because probabilistic risk assessments (PRAs) have been shown to be effective in identifying weak points in plant design and operations, they can help prevent or mitigate future reactor accidents. For the improvement of their effectiveness, two important technical issues need to be addressed: the capability to update PRAs frequently and the proper design objective for measuring plant safety performance. 1 fig.

8923 **Tritium-in-air monitoring: A Canadian perspective.** McElroy, R.G.C.; Wong, K.Y. (Atomic Energy of Canada Research Co.; Canadian Fuels Project). *Nuclear Safety;* **28**: No. 3, 334-340(Jul-Sep 1987).

This article outlines the development of two different tritium-monitoring strategies. Some CANDU power stations rely on multiplexed, centralized tritium monitors whereas the new Darlington station utilizes many simple distributed monitors. The article compares tritium-monitoring requirements at tritium-removal plants and at fusion facilities. A major distinction in contrast with fission reactors is the possible need for tritium monitors that can differentiate between tritiated water vapor and tritium gas. The particularly severe monitoring environment around fusion reactors resulting from air activation products, intense neutron fields, and electromagnetic fields must also be considered. Tritium monitoring around fission reactors is difficult because the environment may contain other radioactive gases and radiation fields. The experience gained may be very valuable in solving the even more difficult tritium-monitoring problems of fusion reactors. 27 refs.

8924 **TMI-2 remote cameras, teleoperators, and other potential nuclear applications.** Pavelek, M.D. II. (Bechtel National, Inc., Oak Ridge, TN). *Nuclear Safety;* **28**: No. 3, 341-349(Jul-Sep 1987).

Evaluation, testing, and use of fixed-position, remotely operated video-camera equipment and various teleoperators at Three Mile Island Nuclear Station Unit 2 (TMI-2) have demonstrated that significant potential advantages may be obtained by installing remotely operated equipment at other nuclear facilities. Teleoperators at TMI-2 have permitted successful operations in areas not accessible to personnel. Insights gained from the remotely operated camera systems and teleoperators used and evaluated at TMI-2 are discussed from the perspective of actual applications and the potential benefits from deployment of remote devices at other nuclear facilities. Actual exposure savings achieved are not presented because these applications and resultant exposure savings are specific to TMI-2. 3 refs., 4 figs.

8925 **Nineteenth DOE/NRC Nuclear Air-Cleaning Conference.** Bellamy, R.R.; Moeller, D.W.; First, M.W. (Nuclear Regulatory Commission; Harvard Univ.). *Nuclear Safety;* **28**: No. 3, 350-361(Jul-Sep 1987).

Conference was held Aug. 18-21, 1986, in Seattle, Washington. Major topics discussed during the conference were accident analyses, including fires and explosions; iodine retention on activated carbon, zeolites, and other sorbent media; particulate filtration; treatment of off-gases from chemical- and fuel-reprocessing systems; noble gas retention; laboratory and in-place testing techniques; and the development of standards and regulations. The conference showed that recent air-cleaning research appears to be directed primarily toward the analysis and critique of existing systems; operational assessment and the potential impact of new source terms are in the forefront. European researchers continue to stress air-cleaning problems associated with spent-fuel reprocessing; US concerns, however, are more in the areas of fire detection, prevention, and elimination and in the operation of control-room habitability systems. 11 refs., 1 tab.

8926 **Steam generator tube performance: Experience with water-cooled nuclear power reactors during 1983 and 1984.** Tatone, O.S.; Meindl, P.; Taylor, G.F. (Chalk River Nuclear Labs., Ontario, Canada). *Nuclear Safety;* **28**: No. 3, 374-390(Jul-Sep 1987).

A review of the performance of steam generator tubes in water-cooled nuclear power reactors showed that tubes were plugged at 47 (35.6%) of the reactors in 1983 and at 63 (42.6%) of the reactors during 1984. In 1983 and 1984, 3291 and 3335 tubes, respectively, were removed from service - about the same as in 1982. The leading causes assigned to tube failure were stress corrosion cracking from the primary side and stress corrosion cracking or intergranular attack from the secondary side. In addition, 5668 tubes were repaired for further service by installation of internal sleeves. Most of these were believed to have deteriorated by one of the preceding mechanisms or by pitting. A trend continues toward high-integrity condenser tube materials at sites cooled by brackish water or seawater. 31 refs., 3 figs., 12 tabs.

8927 **Reactor shutdown experience.** Cletcher, J.W. (comp.). *Nuclear Safety;* **28**: No. 3, 391-393(Jul-Sep 1987).

This section presents a regular report of summary statistics relating to recent reactor shutdown experience. The information includes both numbers of events and rates of occurrence. It was compiled from data about operating events entered into the SCSS data system by the Nuclear Operations Analysis Center at the Oak Ridge National Laboratory, covering the three-month period of January, February, and March 1987. Cumulative information, since May 1, 1984, is also shown. Updates on shutdown events included in earlier reports are excluded. 3 tabs.

8928 **Operating US power reactors.** Silver, E.G. (comp.). *Nuclear Safety;* **28**: No. 3, 394-412(Jul-Sep 1987).

This update, which appears regularly in each issue of Nuclear Safety, surveys the operations of those power reactors in the US which have been issued operating licenses. Table 1 shows the number of such reactors and their net capacities as of March 31, 1987, the end of the three-month period covered in this report. Table 2 lists the unit capacity and forced outage rate for each licensed reactor for each of the three months (January, February, and March 1987) covered in this report and the cumulative values of these parameters since the beginning of commercial operation. 24 refs., 2 tabs.

8929 **General administrative activities.** Silver, E.G. (comp.). *Nuclear Safety;* **28**: No. 3, 413-422(Jul-Sep 1987).

"General Administrative Activities" summarizes selected current topics that are related to nuclear safety but do not fit elsewhere in the journal. Included in this report are items reported during January, February, and March 1987. Subjects discussed, among others, are an NRC proposal to modify the emergency evacuation plan requirement where state and local governments are uncooperative, Advisory Committee on Reactor Safeguards (ACRS) comments on future LWR designs, and several legislative initiatives relating to nuclear safety. 8 refs.

8930 **Reports, standards, and safety guides.** Queener, D.S. *Nuclear Safety;* **28**: No. 3, 423-429(Jul-Sep 1987).

This article contains four lists of various documents relevant to nuclear safety as compiled by the editor. These lists are: (1) reactor operations-related reports of US origin, (2) other books and reports, (3) regulatory guides, and (4) nuclear standards. Each list contains the documents in its category which were published (or became available) during the three-month period (January, February, and March 1987) covered by this issue of Nuclear Safety. The availability and cost of the documents are noted in most instances.

8931 **Status of power-reactor projects undergoing licensing review.** Silver, E.G. (comp.). *Nuclear Safety;* **28**: No. 3, 429-434(Jul-Sep 1987).

Recent regulatory and other actions relating to US power reactors undergoing these steps toward licensing are summarized in this paper for the first quarter of 1987. This section also contains brief reports of regulatory actions and other significant events relating to reactor projects in the licensing stage that were received during the period covered by this report, namely, the first quarter of 1987. 5 refs., 1 tab.

8932 **Underclad cracking of pressure vessel steels for light-water reactors.** Lopez, H.F. (Saltillo Institute of Technology, Apdo. 84-C Saltillo, Coah). *Scripta Metallurgica;* **21**: No. 6, 753-758(Jun 1987).

Although fracture mechanics analyses have shown that underclad cracks have no detrimental effect on the integrity of thick walled pressure vessels (40 year service), in order to avoid unexpected failures the US Nuclear Regulatory Commission has issued Regulatory Guide 1.43 which sets limits on the extent of fissures permitted and describes acceptable means of controlling the weld cladding processes. Cavitation and intergranular fissuring in SA508-2 and 22NiMoCr37 steels can occur in the presence or absence of intergranular particles. The observations of intergranular fissuring and cavitation in those HAZ free from overlapping effects are attributed to grain boundary segregation. Other probable void nucleation sites are the grain boundary-lath interface intersections which facilitate the formation of grain boundary discontinuities.

8933 **Technical note: Systematic procedure for converting event trees to fault trees.** Fullwood, R.W. (Brookhaven National Lab., Upton, NY). *Nuclear Safety;* **28**: No. 2, 170-172(Apr-Jun 1987).

This Technical Note describes a systematic procedure for coding an event tree as a fault tree for input and analysis with a fault-tree analysis code (e.g., SETS or WAMCUT) to obtain the event-tree cutsets.

8934 **Fuel performance annual report for 1983 and 1984.** Bailey, W.J.; Dunenfeld, M.S. (Pacific Northwest Lab., Richland, WA; Nuclear Regulatory Commission, Washington, DC). *Nuclear Safety;* **28**: No. 2, 221-236(Apr-Jun 1987). Contract AC06-76RL01830.

This article summarizes NUREG/CR-3950 (PNL-5210), Vols. 1 and 2, entitled Fuel Performance Annual Report for 1983 and Fuel Performance Annual Report for 1984, respectively. These reports, the sixth and seventh in a series, were published in March 1985 and March 1986, respectively, to provide a summary description of fuel performance in commercial nuclear power plants during 1983 and 1984. Brief summaries of fuel design changes, fuel surveillance programs, fuel operating experience, fuel problems, high-burnup fuel experience, and items of general significance are provided. References to additional, more detailed information and related Nuclear Regulatory Commission evaluations are included.

8935 **Reactor shutdown experience.** Kimmins, A.D.C. (comp.). *Nuclear Safety;* **28**: No. 2, 237-239(Apr-Jun 1987).

This section presents a regular report of summary statistics relating to recent reactor shutdown experience. The information includes both numbers of events and rates of occurrence. It was compiled from data about operating events entered into the RECON data system by the Nuclear Operations Analysis Center at the Oak Ridge National Laboratory, covering the three-month period of October, November, and December 1986. Cumulative information, since May 1, 1984, is also shown. Updates on shutdown events included in earlier reports are excluded.

8936 **Selected safety-related events reported in October, November, and December 1986.** Murphy, G.A. (comp.). *Nuclear Safety;* **28**: No. 2, 240-242(Apr-Jun 1987).

On Tuesday, Dec. 9, 1986, at 2:20 p.m., both units at the Surry Power Station 788-MW(e) Westinghouse pressurized-water reactors (PWRs), operated by Virginia Electric Power Company (VEPCo), were operating at full power when an 18 in. suction line to main feedwater pump A for Unit 2 failed catastrophically. Eight workers who were replacing thermal insulation on a nearby line were burned by flashing feedwater. All were transported to area hospitals. Two workers were treated and released. Four other workers subsequently died. This report describes the factors involved in the accident and discusses American Society of Mechanical Engineers (ASME) codes related to this event.

8937 **Operating US power reactors.** Silver, E.G. (comp.). *Nuclear Safety;* **28**: No. 2, 243-258(Apr-Jun 1987).

This update, which appears regularly in each issue of Nuclear Safety, surveys the operations of those power reactors in the US which have been issued operating licenses. Table 1 shows the number of such reactors and their net capacities as of Dec. 31, 1986, the end of the three-month period covered in this report. Table 2 lists the unit capacity and forced outage rate for each licensed reactor for each of the three months (October, November, and December 1986) covered in this report and the cumulative values of these parameters since the beginning of commercial operation. They are defined as follows: In addition to the tabular data, this article discusses significant occurrences and developments that affected licensed US power reactors during this reporting period. It includes, but is not limited to, changes in operating status, regulatory actions and decisions, and legal actions involving the status of power reactors. We do not have space here for routine problems of operation and maintenance, but such information is available at the Nuclear Regulatory Commission (NRC) Public Document Room, 1717 H Street, NW, Washington, DC 20555. Some significant operating events are summarized elsewhere in this section in the article "Selected Safety-Related Events," and a report on activities relating to facilities still in the construction process is given in the article "Status of Power-Reactor Projects Undergoing Licensing Review" in the last section of each issue of this journal. The reader's attention is also called to the regular feature "General Administrative Activities," which deals with more general aspects of regulatory and legal matters that are not covered elsewhere in the journal.

8938 **General administrative activities.** Silver, E.G. (comp.). *Nuclear Safety;* **28**: No. 2, 259-273(Apr-Jun 1987).

"General Administrative Activities" summarizes selected current topics that are related to nuclear safety but do not fit elsewhere in the journal. Included in this report are items reported during October, November, and December 1986. Subjects discussed, among others, are Advisory Committee on Reactor Safeguards (ACRS) suggestions for a Nuclear Regulatory Commission (NRC) long-range plan, legislation introduced to Congress that would give states veto power over reactor licensing, and an NRC proposal for changing the timing requirements for offsite emergency tests prior to issuance of an operating license.

8939 **Reports, standards, and safety guides.** Queener, D.S. *Nuclear Safety;* **28**: No. 2, 274-281(Apr-Jun 1987).

This article contains four lists of various documents relevant to nuclear safety as compiled by the editor. These lists are: (1) reactor operations-related reports of US origin, (2) other books and reports, (3) regulatory guides, and (4) nuclear standards. Each list contains the documents in its category which were published (or became available) during the three-month period (October, November, and December 1986) covered by this issue of Nuclear Safety. The availability and cost of the documents are noted in most instances.

8940 **Status of power-reactor projects undergoing licensing review.** Silver, E.G. (comp.). *Nuclear Safety;* **28**: No. 2, 281-292(Apr-Jun 1987).

The Energy Reorganization Act of 1974 gives the Nuclear Regulatory Commission (NRC) authority over the licensing of atomic energy facilities under conditions that will protect the health and safety of the public from excessive exposure to radiation hazards. As an aid in fulfilling this responsibility, the NRC has developed regulations that are contained in Title 10 of the Code of Federal Regulations. Under the Act and these regulations, the NRC is required to make certain safety findings before a construction permit or an operating license for a facility can be issued. These findings are based on extensive technical analyses and environmental assessments that are carefully reviewed by the NRC staff. The safety evaluation is also reviewed by the Advisory Committee on Reactor Safeguards (ACRS), an independent board set up for such reviews. In addition, a public hearing is required before a construction permit can be issued and must also be held at the operating-license stage if any person or organization whose interests may be affected requests it. Recent regulatory and other actions relating to US power reactors undergoing these steps toward licensing are summarized in Table 1 for the fourth quarter of 1986. The NRC documents referenced in this section are generally available at the NRC Public Document Room, 1717 H Street NW, Washington, DC 20555. This section also contains brief reports of regulatory actions and other significant events relating to reactor projects in the licensing stage that were received during the period covered by this report, namely, the last quarter of 1986.

8941 **PRISM: an innovative inherently safe modular sodium cooled breeder reactor.** Pluta, P.R.; Tippets, F.E.; Murata, R.E.; Boardman, C.E.; Schatmeier, C.S.; Dubberley, A.E.; Switick, D.M.; Kwant, W. (General Electric Co., Sunnyvale, CA). pp 109-203 of Advances in nuclear science and technology. Volume 19. Lewins, J.; Becker, M. (eds.). New York, NY; Plenum Press (1987).

The Power Reactor Inherently Safe Module (PRISM) is a sodium-cooled breeder reactor concept. The 415 MWe power block is composed of three identical reactor modules each rated at 425 MW of thermal power with separate standardized steam generator systems. The reference 1245 MWe plant employs nine PRISM reactors and three turbine generators when fully operational. The design for the reactor modules is standardized, may be built in a factory, and can be shipped by rail or barge. The reactor refueling facility, modules and their auxiliary equipment comprise the principal nuclear safety related portion of the plant. In sections two through four of the paper, the authors describe and illustrate the main features of the plant; the reactor assembly and support structures; and, heat transport and power generation systems. Section five describes the shutdown heat removal systems. The PRISM plant is equipped with three methods of removing shutdown heat from the reactor: condenser cooling, the auxiliary cooling system, and the reactor vessel auxiliary cooling system. Description, performance, operation, and order of use are discussed in this section. PRISM's inherent safety characteristics are described in section six. Briefly, these features include: natural convection air cooling for reactor emergency decay heat removal, passive negative reactivity feedback from core thermal effects; and, the backup oxide core which has a self-actuated shutdown system for control rod scram and control rod withdrawal limiters to restrict rod withdrawal transients. The authors summarize the concept and implementation strategy.

8942 **Insights from an overview of four PRAs.** Fitzpatrick, R.; Arrieta, L.; Teichmann, T.; Davis, P. New York, NY; American Society of Mechanical Engineers (1987). 5p. (CONF-861211—). American Society of Mechanical Engineers, 345 East 47 St., New York, NY 10017.

From American Society of Mechanical Engineers winter meeting; Anaheim, CA, USA (7 Dec 1986).

Technical Paper 86-WA/NE-13.

This paper summarizes the findings of an investigation of four probabilistic risk assessments (PRAs), those for Millstone 3 Seabrook, Shoreham, and Oconee 3, performed by Brookhaven National Laboratory (BNL) for the Reliability and Risk Assessment branch of the U.S. Nuclear Regulatory Commission (NRC). This group of four PRAs was subjected to an overview process with the basic goal of ascertaining what insights might be gained (beyond those already documented within the individual PRAs) by an independent evaluation of the group with respect to nuclear plant safety and vulnerability. Specifically, the objectives of the study were 1) to identify and rank initiators, systems, components, and failure modes from dominant accident sequences according to their contribution to core melt probability and public risk; and 2) to derive from this process plant-specific and generic insights. The effort was not intended to verify the specific details and results of each PRA but rather - having accepted the results - to see what they might mean in a more global context. This paper also presents some comments and insights into the amenability of certain features of these PRAs to this type of overview process.

8943 **Integral fast reactor concept inherent safety features.** Marchaterre, J.F.; Sevy, R.H.; Cahalan, J.E. New York, NY; American Society of Mechanical Engineers (1987). 4p. (CONF-861211—). American Society of Mechanical Engineers, 345 East 47 St., New York, NY 10017.

From American Society of Mechanical Engineers winter meeting; Anaheim, CA, USA (7 Dec 1986).

Technical Paper 86-WA/NE-14.

The Integral Fast Reactor (IFR) is an innovative liquid-metal-cooled reactor concept being developed at Argonne National Laboratory. The two major goals of the IFT development effort are improved economics and enhanced safety. The design features that together fulfill these goals are: 1) a liquid metal (sodium) coolant, 2) a pool-type reactor primary system configuration, 3) an advanced ternary alloy metallic fuel, and 4) an integral fuel cycle. This paper reviews the design features that contribute to the safety margins inherent to the IFR concept. Special emphasis is placed on the ability of the IFR design to accommodate anticipated transients without scram (ATWS).

8944 **Analysis of the results of the midland PRA.** Bozoki, G.; Teichmann, T. New York, NY; American Society of Mechanical Engineers (1987). 5p. (CONF-861211—). American Society of Mechanical Engineers, 345 East 47 St., New York, NY 10017.

From American Society of Mechanical Engineers winter meeting; Anaheim, CA, USA (7 Dec 1986).

Technical Paper 86-WA/NE-12.

This paper presents the results of a limited review of the Midland PRA (MPRA), aimed at facilitating regulatory analyses and at providing insights into safety related plant failures. In particular, stress was laid on the root causes of accident sequences, particularly their failure modes, viz., hardware, human, maintenance, test, and repair. Because this information was difficult to extract in this detailed and sophisticated PRA (and in certain others) a special algorithm was developed to display the leading sequences contributing to core damage and/or to public risk in terms of the above generic failure modes. This was done in a hierarchical fashion to allow tracing the important accident sequences to the systems failures. The weighted core damage frequency (CDF) values of the sequences considered then provided a (quantitative) ranked importance listing of these failure modes, led by hardware failures (in 78%) and human factors (in 37%), etc. Multiple maintenance situations (reflecting on test and maintenance specifications) were also evaluated, but played only a small role (≦3%). Similar tabulations were also made of the (weighted) importance of the support systems (such as the electric power system, the component cooling water systems, etc.) and of the role of the major systems/functions (e.g., high pressure injection, etc.) contributions to these accident sequences. Finally, the role of certain particular operational and plant features (e.g., loss of offsite power initiators, RCP seal, failure, bunkering, etc.) were briefly examined.

8945 **Importance measures and resource allocation.** Guey, C.N.; Morgan, T.; Hughes, E.A. New York, NY; American Society of Mechanical Engineers (1987). 5p. (CONF-861211—). American Society of Mechanical Engineers, 345 East 47 St., New York, NY 10017.

From American Society of Mechanical Engineers winter meeting; Anaheim, CA, USA (7 Dec 1986).

Technical Paper 86-WA/NE-10.

This paper discusses various importance measures and their practical relevance to allocating resources. The characteristics of importance measures are illustrated through simple examples. Important factors associated with effectively allocating resources to improve plant system performance or to prevent system degradation are discussed. It is concluded that importance measures are only indicative of and not equal to the risk significance of a component, system, or event. A decision framework is suggested to provide a comprehensive basis for resource allocation.

8946 **Circuit breaker operation and potential failure modes during an earthquake.** Lambert, H.E.; Budnitz, R.J. New York, NY; American Society of Mechanical Engineers (1987). 5p. (CONF-861211—). American Society of Mechanical Engineers, 345 East 47 St., New York, NY 10017.

From American Society of Mechanical Engineers winter meeting; Anaheim, CA, USA (7 Dec 1986).

Technical Paper 86-WA/NE-9.

This study addresses the effect of a strong-motion earthquake on circuit breaker operation. It focuses on the loss of offsite power (LOSP) transient caused by a strong-motion earthquake at the Zion Nuclear Power Plant. This paper also describes the operator action necessary to prevent core melt if the above circuit breaker failure modes occur simultaneously on three 4.16 KV buses. Numerous circuit breakers important to plant safety, such as circuit breakers to diesel generators and engineered safety systems (ESS), must open and/or close during this transient while strong motion is occurring. Potential seismically-induced circuit-breaker failures modes were uncovered while the study was conducted. These failure modes include: circuit breaker fails to close; circuit breaker

trips inadvertently; circuit breaker fails to reclose after trip. The causes of these failure modes include: Relay chatter causes the circuit breaker to trip; Relay chatter causes anti-pumping relays to seal-in which prevents automatic closure of circuit breakers; Load sequencer failures. The incorporation of these failure modes as well as other instrumentation and control failures into a limited scope seismic probabilistic risk assessment is also discussed in this paper.

8947 **Nuclear power after Chernobyl.** Rossin, A.D. (U.S. Dept. of Energy, Washington, DC). pp 11-14 of Waste management '87: Waste isolation in the US, technical programs, and public education. Post, R.G. Tucson, AZ; University of Arizona Nuclear Engineering Dept. (1987). (CONF-870306—).

From Waste management '87; Tucson, AZ, USA (1 Mar 1987).

The Chernobyl accident has had a significant impact on the perception of nuclear power throughout the world. The Soviet reactor program has resumed, but delays in programs of other nations have occurred. Even though the implications of the accident to the U.S. program are small because of differences in design and operating practices, some have used the occasion to attempt to demand special safeguards, impractical emergency plans, or to shut down plants. The media has a special responsibility to ensure that the complete facts are available to allow informed public opinion. Resumption of the nuclear option in the United States requires resolution of institutional issues and development of standardized designs.

8948 **Future nuclear reactors - safety first.** Klueh, R. (Oak Ridge National Lab., TN, USA). *New Scientist (London);* **110**: No. 1502, 41-45(3 Apr 1986).

The paper concerns future nuclear reactors, whose safety is built into the design of the reactors i.e. inherently safe reactors. The most promising inherently safe reactors are the PIUS (process inherent ultimate safety) reactor designed by ASEA-ATOM of Sweden, and modular high-temperature, gas-cooled reactors designed by Interatom in West Germany and GA Technologies in the U.S. The concept of inherent safety of both of these reactors is discussed in detail, along with the advantages and problems of the design. The complexity of conventional reactors is also described. (U.K.).

8949 **Suppression of steam explosions in tin and Fe-Al_2O_3 melts by increasing the viscosity of the coolant.** Nelson, L.S.; Guay, K.P. (Sandia National Labs., Albuquerque, NM, USA). *High Temperatures - High Pressures;* **18**: No. 1, 107-111(1986). Contract AC04-76DP00789.

Steam explosions, energetic interactions that sometimes occur when a melt and water come together, can be suppressed by increasing the viscosity of the aqueous phase. This has been demonstrated both in the laboratory with drops of molten tin released into aqueous glycerol or cellulose gum solutions, and in one field-scale experiment where 50 kg of molten Fe-Al_2O_3 was released into a cellulose gum solution; vigorous spontaneous explosions occurred in both situations when the cold liquid was water alone. There is a threshold solution viscosity near 0.015 Pa s, above which spontaneous tin drop explosions no longer occur. Increase of coolant viscosity might prevent injury to workers and damage to equipment in industrial processes where melts are normally handled near cooling water.

25 ENERGY STORAGE

2506 Thermal

8950 **(IKE—5-223) Mathematical treatment of melting and solidification of phase change materials between circumferentially finned tubes.** Heinisch, M. (Stuttgart Univ. (Germany, F.R.). Inst. fuer Kernenergetik und Energiesysteme; Stuttgart Univ. (Germany, F.R.). Fakultaet 5 - Energietechnik). Jan 1987. 135p. (In German). NTIS (US Sales Only), PC A07/MF A01. Order Number DE88750531/JAW.

The following study deals with the theoretical investigation of heat transfer in a latent heat store. The object of the investigation is a heat exchanger element with a circumferentially finned tube, in which the space between the fins is filled with storage material. An analytical method, employing Green's function, was developed for this arrangement in order to solve the two dimensional (r,z-coordinates) transient heat conduction in inhomogenous materials with simultaneous phase change. When compared with other well-known analytical methods, the most important advantages are that the Fourier heat conduction equation and the boundary conditions at the phase front are simultaneously fulfilled by the final solution, as well as the fact that the initial temperature is independent of a given phase change temperature. A fundamental advantage can also be seen in the very small number of time steps for calculating the transient charging/discharging processes and hence shorter calculation times. Two special extreme cases were designed where the results agree well with literature data. In comparison with the numerically calculated melting and solidification behaviour only small variations were observed.

8951 **Phase change thermal energy storage material.** Benson, D.K.; Burrows, R.W. (to Dept. of Energy, Washington, DC). US Patent 4,702,853. 27 Oct 1987. Filed date 6 Oct 1986. vp. Patent and Trademark Office, Box 9, Washington, DC 20232.

A thermal energy storage tank is described comprising a containment vessel arranged for exposure to thermal energy, and a thermal energy storage composition disposed within the vessel and comprising a non-chloride hydrate having a phase change transition temperature in the range of 70°-95°F and a latent heat of transformation of greater than about 35 calories/gram. The non-chloride hydrate comprises trimethyol ethane hydrate.

2509 Batteries

REFER ALSO TO CITATION(S) 9229

8952 **(NP—8750527) Electrochemical studies on the lead-acid battery especially on the behaviour of the positive plate. Final report.** Rickert, H.; Pohl, J.P. (Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). Dec 1985. 93p. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88750527/JAW.

The purpose of this research project was to carry out electrochemical investigations on the behaviour of the positive plate of the lead-acid battery, i.e. the lead dioxide electrode. The investigations concern the stationary and non-stationary kinetic behaviour of PbO/sub 2/ in H/sub 2/SO/sub 4//PbSO/sub 4/(s) electrolytes and the diffusion of hydrogen within the oxide being in contact with HClO/sub 4//Pb(ClO/sub 4/)/sub 2/ and H/sub 2/SO/sub 4//PbSO/sub 4/(s) electrolytes. The results are of interest with respect to the cut - in behaviour of the positive plate at prolonged current load. The results of pulse measurements, carried out to investigate the initial behaviour of the PbO/sub 2/ electrode, show that the stoichiometry changing reaction at the phase boundary PbO/sub 2//electrolyte proceeds relatively uninhibited; the exchange current densities are in the order of magnitude of 100 mAcm/sup -2/. As a result of investigations on the stationary behaviour of PbO/sub 2/ 'quasi-stationary' current voltage curves have been obtained for different degrees of PbSO/sub 4/ coverage, indicating that the deposition/dissolution reaction of the oxide is much more inhibited than the reaction of hydrogen insertion/dissolution. The diffusion of hydrogen in PbO/sub 2/ has been investigated using potential step measurements. The values of the chemical diffusion coefficient are in the order of magnitude of 10/sup -7/ cm/sup 2/s/sup -1/. With 32 refs., 6 tabs., 22 figs..

29 ENERGY PLANNING AND POLICY

2901 Energy Analysis And Modeling

REFER ALSO TO CITATION(S) 8967

2902 Economics And Sociology

REFER ALSO TO CITATION(S) 8657, 8658, 8659, 8660, 8947, 9018, 9970

8953 (ORNL/TM—10642) Community coordination plan for basing the B-2 bomber at Whiteman Air Force Base, Missouri. Braid, R.B.; Kornegay, F.C.; Lasley, B.D.; Sage, P.; Fichera, J.P.; Lufkin, P.; Taylor, L. (Oak Ridge National Lab., TN (USA); URS Corp., Santa Barbara, CA (USA)). Nov 1987. Contract AC05-84OR21400. 103p. NTIS, PC A06/MF A01; 1; GPO Dep. Order Number DE88003700/JAW.

This preliminary report examines the potential community impacts of basing the B-2 bomber at Whiteman Air Force Base (AFB), Missouri. The study focuses on examining the direct and indirect employment, population, and income impacts of the B-2 on the socioeconomic resources of the communities neighboring the base. The specific socioeconomic resources analyzed are housing, education, transportation, land use, utilities, public finance, and community services, such as fire and police protection.

2903 Environment, Health, And Safety

REFER ALSO TO CITATION(S) 8466, 8546, 8553, 8556, 8578, 8601, 8657, 8664, 8769, 8770, 8878, 8916, 8917, 8923, 8937, 9007, 9019, 9284, 9285, 9286, 9473, 9485

8954 (PB—88-100102/XAB) Risk assessment, management, communication: a guide to selected sources. Second update. Information guide. (Environmental Protection Agency, Washington, DC (USA). Information Management and Services Div.). Aug 1987. 61p. (EPA/IMSD—87/002B). NTIS, PC A04/MF A01.

See also PB—87-203402.

This second quarterly update to Risk Assessment, Management, Communication: A Guide to Selected Sources contains references gathered from the following databases: Toxline, Conference Papers Index, ENVIROLINE, National Technical Information Service (NTIS), Public Affairs Information Service (PAIS), ABI Inform, and Legal Resource Index. They cover the period from January through June 1987. The risk-update series is subdivided into three major sections: Assessment, Management, and Communication.

8955 (PB—88-100631/XAB) Toward the quantification of visibility: an annotated bibliography. Gallagher, V.P.; McCunney, W.D.; Thornton, J.R. (Franklin Inst. Research Labs., Philadelphia, PA (USA). Science Information Services Dept.). Jan 1977. 88p. NTIS, PC A05/MF A01.

Also available from Supt. of Docs. See also final report, PB—82-238916.

A literature search was conducted in the field of visibility using the term as a warning against stationary or moving hazards. The review was conducted to establish the extent of research conducted on the Visibility Index. The Index was designed to provide the method for examining the effective value of such properties as color, texture, pattern, contrast, and other variables which can be used to improve the effectiveness of warning devices, signs, labels, and markings aimed at providing increased safety through visible means. Future research was to be conducted in order to evaluate the effectiveness of increasing visibility as a means of reducing the hazard of a worker being struck or injured because he was not able to see a hazard in his path. References were cited for existing standards for visibility in the U.S. and foreign countries along with international standards. Other areas for which references were listed include current practices (air and ground transportation, safety clothing, underwater visibility, visibility measurement, and industrial and occupation applications), design factors (camouflage, pattern recognition, color contrast, luminance contrast, area, and reflectivity), and environmental variables (illumination, background, types of lighting, distance and moving targets).

2904 Natural Resources

8956 (TVA/ONRED/LER—87/22) TVA/Forestry on track for the future. (Tennessee Valley Authority, Norris (USA). Forest Resources Development Program). Oct 1987. 15p. NTIS, PC A03/MF A01. Order Number DE88900183/JAW.

This booklet discusses the role of TVA in the development of the forestry industry in the Tennessee Valley. Topics include the resource, managing the forests, harvesting, and marketing. (ACR)

2905 Research, Development, Demonstration, And Commercialization

REFER ALSO TO CITATION(S) 8374, 8455, 8719, 8747, 8753, 8754, 8756

8957 (DOE/PC/80009—T20, pp 201-217) Technology assessment and forecasting. Bozeman, B.; Meyer, W. (Syracuse Univ., NY). 29 Jun 1987. NTIS, PC A10/MF A01. Order Number DE87014387/JAW.

In Cooperative research in coal liquefaction infratechnology and generic technology development: Final report, October 1, 1985 to December 31, 1986.

The purpose of this concluding chapter is to distill the information provided by each of the perspective chapters - economic policy, technological, and generally, historical - and draw broad conclusions. These conclusions represent, in a sense, a synthesis of the various perspectives taken. There are six chief conclusions presented or, more accurately, five conclusions and one overarching theme. 26 refs.

8958 (ORNL/PPA—87/3) Competitiveness, technology, and ORNL. Kash, D.E. (Oklahoma Univ., Norman (USA)). Oct 1987. Contract AC05-84OR21400. 35p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88003731/JAW.

This paper builds a framework for addressing how ORNL might increase its contribution to US competitiveness. It begins with an analysis of the changing nature of international commercial competition. The goal in the first part of the paper is to provide a picture of why US competitiveness has eroded and what is required if the nation is to be competitive. The latter portion of the paper investigates actions which might be taken to enhance the Lab's potential for contributing to commercially competitive innovations.

2906 Nuclear Energy

REFER ALSO TO CITATION(S) 8546, 8551, 8556, 8578, 8601, 8664, 8825, 8870, 9284, 9285, 9286

8959 (INIS-GB—27) EDRP public local inquiry, UKAEA/BNFL precognition on: Aspects of Dounreay safety and local liaison relevant to EDRP. Blumfield, C.W. (UKAEA Headquarters, London; British Nuclear Fuels Ltd., Risley). Jan 1986. 21p. (DP—9). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88750775/JAW.

Aspects of safety at Dounreay Nuclear Establishment, including legislation, design safety, industrial safety and radiation monitoring procedures, are discussed. The arrangements for action in an emergency are outlined. Liaison between DNE and the local community, formal and informal, is summarised. (U.K.).

2908 Waste Heat Utilization

REFER ALSO TO CITATION(S) 9001, 9004, 9008

2910 Conservation

REFER ALSO TO CITATION(S) 8993

2920 Supply, Demand, And Forecasting

REFER ALSO TO CITATION(S) 8755, 8769

2930 Policy, Legislation, And Regulation

REFER ALSO TO CITATION(S) 8403, 8551, 8553, 8556, 8718, 8917, 8925, 8937, 8938, 8939, 8940, 8964, 9284, 9285, 9286, 9857, 9860

2940 Fossil Fuels

REFER ALSO TO CITATION(S) 8374, 8403, 8770

8960 **(NP—8750523) AFM annual report 1986.** (Aussenhandelsverband fuer Mineraloel e.V., Hamburg (Germany, F.R.)). Jun 1987. 43p. (In German). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88750523/JAW.

After a general outline, special events on the German petroleum market are reviewed. Statistical tables of the petroleum industry are presented. The most recent data are of 1986.

8961 **(NP—8750524) MWV petroleum data 1986.** (Mineraloelwirtschaftsverband e.V., Hamburg (Germany, F.R.)). 1987. 54p. (In German). NTIS (US Sales Only), PC A4. Order Number DE88750524/JAW.

Detailed tables provide information on capacities, petroleum supply, consumption, prices, exports, and energy consumption in the Federal Republic of Germany, followed by tables on important world petroleum data. The most recent data are of 1986.

8962 **(NP—8750525) EDP-assisted system for the optimization of long-term production planning by hard-coal mines. Vol. 1. Final report.** Kraushaar, D.; Meyer-Funke, A.G. (Ruhrgas A.G., Essen (Germany, F.R.); Bergbau-Forschung G.m.b.H. Forschungsinstitut des Steinkohlenbergbauvereins, Essen (Germany, F.R.); Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). Aug 1987. 114p. (In German). NTIS (US Sales Only), PC A06. Order Number DE88750525/JAW.

Assistance of the production planning by the mines of a hard-coal mining company (RAG) for several decades. The planning system comprises methods of evaluating the coal reserves contained in unworked seams, winning areas and primary development requirements, investments and mining damages, of establishing and harmonizing production planning, of representing mine plans. To accomplish the required forecasts, evaluated data from operational data files are made available to the planning engineer. With 16 refs., 7 tabs., 6 figs..

2960 Electric Power

REFER ALSO TO CITATION(S) 8769, 8770

8963 **(CONF-8706230—1) Assessment of long-run marginal costs for designing electricity tariffs based on analysis of electric power least-cost expansion programs.** Buehring, W.A.; VanKuiken, J.C. (Argonne National Lab., IL (USA)). 1987. Contract W-31109-ENG-38. 80p. NTIS, PC A05/MF A01; 1; GPO Dep. Order Number DE88003081/JAW.

From World Bank's meeting of the regional energy planning project at the International Atomic Energy Agency; Vienna, Austria (22 Jun 1987).

Estimates of long-run marginal cost (LRMC) for electrical generation are an important ingredient in designing economically efficient tariffs. An approach that relies on results from a widely accepted generation planning model for estimation of LRMC has been developed and applied in recent years. The model, the Wien Automatic System Planning Package (WASP-III), is supported and distributed by the International Atomic Energy Agency (IAEA). For estimation of marginal energy cost and other important planning information, the Model for Investigation of Costs and Reliability for Utility Systems (ICARUS) is used together with the least-cost expansion plan determined by WASP-III. An overview of the methodology and models is provided.

8964 **(DOE/CS/40244—T1) Section 210 of the Public Utility Regulatory Policies Act: A handbook for small power producers.** (Texas Public Utility Commission, Austin (USA)). [1980]. Contract FG46-80CS40244. 16p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88002727/JAW.

Purpose of this manual is to acquaint electric utility customers who generate electricity from renewable resources for their own use or for sale to an electric utility with the Public Utility Regulatory Policies Act (PURPA). Although PURPA addresses many energy issues, Sections 201 and 210 of PURPA are concerned with the purchases and sales of electric power between certain qualifying facilities and electric utilities. Under rules established by the Federal Energy Regulatory Commission (FERC) a qualifying facility may be either a cogenerator or a small power producer, but for the purpose of this manual the focus will be on small power producers. A small power production facility is a facility which produces electric energy with renewable resources comprising at least 75% of the total fuel source and which is not greater than 80 megawatts in total installed capacity. Wind energy conversion devices, solar photovoltaics, hydroelectric systems, and electric generators fueled by waste or biomass are all examples of small power production facilities.

8965 **(NERC—8900182) 1987/88 winter assessment of overall reliability of bulk electric supply.** (North American Electric Reliability Council, Princeton, NJ (USA)). Nov 1987. 21p. North American Electric Reliability Council, 101 College Road East, Princeton, New Jersey 08540-6601. Order Number TI88900182/JAW.

Each region of the North American Electric Reliability Council expects its 1987/88 winter peak demand to exceed last winter's. However, each region also expects to have adequate generating capacity to meet its demand, assuming normal winter weather and average power plant reliability. Should this winter be much colder than normal, or if generating equipment breaks down more often than expected, some utilities, especially in New England, may need to buy electricity from other systems. If severely cold weather blankets a large area of North America, it is always possible that some utilities might have to curtail their customers' electricity use. Transmission system capability is expected to be adequate to allow utilities to help each other if generating capacity shortages suddenly develop. However, some transmission lines are already loaded up to their safe operating limit with economy electricity transfers between utilities. This heavy loading stresses the system and increases the risk of reliability problems. Utilities must continue to monitor these lines carefully to maintain reliability. 1 fig., 3 tabs.

8966 **(ORNL/Sub—86-56559/1) Prudence issues affecting the US electric utility industry.** (United Engineers and Constructors, Inc., Philadelphia, PA (USA)). Dec 1987. Contract AC05-84OR21400. 155p. NTIS, PC A08/MF A01; 1; GPO Dep. Order Number DE88004774/JAW.

The cost impact to private utilities resulting from prudence hearings before State Public Utility (Service) Commissions is currently a matter of considerable concern to investors and the nation. Cost disallowances for many utilities threaten the economic health of the companies. The disallowances, which deny full construction cost recovery to utilities, have had a negative effect on the ordering of any new base load power plants, either nuclear or coal. They have contributed to the fact that no nuclear plants have been or-

dered since 1978, and none are currently being planned in the US. This situation has led to a major national concern that adequate, reliable and economic electric power may not be available to fully meet future needs of the country. The US Department of Energy is addressing the institutional, financial and regulatory problems of the nuclear power industry. This report addresses the prudence issues aspect of this program. This includes the development of a body of data depicting the causes of electric power plant cost disallowances, analysis of the causes and their impact, and the development of recommended actions that may eliminate or alleviate the negative conditions found.

2980 Consumption And Utilization

REFER ALSO TO CITATION(S) 8769, 8988

2990 Unconventional Sources And Power Generation

REFER ALSO TO CITATION(S) 8718, 8719, 8747, 8753, 8754, 8755, 8756

8967 **(NP—8750535) Evaluating renewable and energy-conserving energy technologies suggested in existing energy demand forecasts. A comparative analysis of the effects of technological innovations on the forecasting of future energy demands. Final report.** Weber-Carstanjen, T. (Prognos A.G., Basel (Switzerland)). Feb 1987. 156p. (In German). NTIS (US Sales Only), PC A08/MF A01. Order Number DE88750535/JAW.

In a comparative evaluation five energy forecasts assessing the development of demands through the year 2000 are analysed for the value of suggestions concerning energy-conserving energy technologies. A definition of relevant terms is followed by a description of the proceeding as such. Analyses are characterized by sharp disaggregations. The selected scenarios (limitations of the nuclear power industry, the PROGNOS and SHELL studies, the 'turning point', energy 2000) are described both qualitatively and quantitatively. The description is followed by an evaluation on the basis of related studies. The final chapter contains an overall statement and recommendations.

30 DIRECT ENERGY CONVERSION

3001 Mhd Generators

8968 **(DOE/PC/70507—12) MHD [magnetohydrodynamics] channel development: Quarterly report for January 1987-March 1987.** (Avco Research Lab., Inc., Everett, MA (USA)). Apr 1987. Contract AC22-84PC70507. 120p. NTIS, PC A06/MF A01; 1; GPO Dep. Order Number DE88002412/JAW.

During the report period several slag doping tests were performed. Four of these tests are described in this report. The results were generally encouraging. Four dopants were investigated: Fe_2O_3, Fe_3O_4, MnO, and CrO_3. All but the CrO_3 proved effective within some range of dopant flow rate. At flow rates above or below this range none of the dopants were desirable. The proper ranges for each of the dopants was coarsely mapped in these experiments. When the dopants were injected directly on the anode wall a power increase was observed. This indicates a possible reduction in the voltage drop due to the presence of the dopant. No power gain or loss was observed when the dopant was injected on the cathode wall. However, inter-cathode voltages were observed to spread more uniformly along the wall. High voltages decreased and low voltages increased. This result should help to reduce wear on the cathodes and their neighboring wall elements by reducing the local electrical field. Current control circuits were tested on both MK VI and MK VII type generators and components for consolidation circuits ordered. Solutions to waste disposal problems created by the implementation of new environmental regulations are being investigated. The MHD generator data from the CDIF 87-SEED-1, 87-SEED-2, and 87-SEED-3 tests have been analyzed and the results are presented in this report. The results of the SIDA model presented in this quarterly report are obtained by assuming a constant boundary layer voltage drop. Variations in the boundary layer voltage drop as a result of diagonal loading changes, iron oxide addition, or seeding rates changes were not considered. Corrections for the effects of $\Delta V/sub\ b1/$ will be made to the results of SIDA when the voltage drop measurements become available.

3004 Thermionic Converters

REFER ALSO TO CITATION(S) 9067

3005 Fuel Cells

REFER ALSO TO CITATION(S) 9229

8969 **(DOE/ET/11304—2385) Development of molten carbonate fuel cell technology: Quarterly technical status report, January-March 1986.** (Energy Research Corp., Danbury, CT (USA)). Mar 1986. Contract AC21-76ET11304. 65p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE87006509/JAW.

The program reported is divided into three tasks: Design; Component Development; and Verification Tests. The objective of Design is to identify a reference application for an internal reforming power plant and to develop a power plant conceptual design and detailed stack design. The objective of Component Development is to develop, fabricate, and test components to meet the Component Functional Requirements (CFRs). The objective of Verification Tests is to determine if the cell components have attained the CFR goals. 13 figs., 15 tabs. (FI)

8970 **(DOE/ET/11304—2386) Development of molten carbonate fuel cell technology: Quarterly technical status report, April-June 1986.** (Energy Research Corp., Danbury, CT (USA)). Jun 1986. Contract AC21-76ET11304. 84p. NTIS, PC A05/MF A01; 1; GPO Dep. Order Number DE87006510/JAW.

The program reported is divided into three tasks: Fuel Cell Plant Design; Component Development; and Verification Tests. The objective of Design is to identify a reference application for an internal reforming power plant and to develop a power plant conceptual design and detailed stack design. The objective of Component Development is to develop, fabricate and test components to meet the Component Functional Requirements (CFRs). The objective of Verification Tests is to determine if the cell components have attained the CFR goals. 25 figs., 14 tabs.

8971 **(DOE/ET/11304—2387) Reforming stack development: Quarterly technical status report, July-September 1986.** (Energy Research Corp., Danbury, CT (USA)). Sep 1986. Contract AC21-76ET11304. 53p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE87006511/JAW.

The program reported is divided into three tasks: Stack Design; Component Development; and Verification Tests. The objective of Design is to identify a reference application for an internal reforming power plant and to develop a power plant conceptual design and detailed stack design. The objective of Component Development is to develop, fabricate and test components to meet the Component Functional Requirements (CFRs). The objective of Verification Tests is to determine if the cell components developed have attained the CFR goals.

8972 **(DOE/MC/23264—2507) Determination of optimum electrolyte composition for molten carbonate fuel cells literature review: Topical report.** Yuh, C.Y.; Pigeaud, A. (Energy Research Corp., Danbury, CT (USA)). Apr 1987. Contract AC21-86MC23264. 63p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE88001015/JAW.

Our review of the earlier cell testing data suggests that a more conductive electrolyte may improve total cell performance, primarily as a result of reduction of IR-loss in the electrolyte tile or matrix. This IR loss contributes significantly to cell performance loss. However, electrode performances could not be correlated very well with either potassium content or electrolyte conductivity,

primarily due to possible off-setting effects in cathode kinetics, mass transfer, and ohmic resistance inside this porous electrode. The cell data discussed above concerned only short-term results and thus only the effects on performance were studied. The problems affecting endurance, e.g., corrosion, NiO dissolution, and matrix support stability could not be analyzed in these tests. This review therefore indicated that optimization of electrolyte composition is potentially available and could be beneficial to arrive at an optimum combination of performance/endurance and cost factors. Further systematic and careful experimental work will be necessary while emphasizing the need for repeatability and long-term stable and representative conditions. ERC feels that an important part of our approach must be to emphasize duplication and repeatability as well as relatively long-term, large cell, testing. All parameters, except electrolyte composition, will be identical so that definitive data will be developed with regard to the electrolyte performance.

32 ENERGY CONSERVATION, CONSUMPTION, AND UTILIZATION

3201 Buildings

REFER ALSO TO CITATION(S) 8468, 8717, 9266, 9267

8973 (BMFT-FB-T—86-191) Energy saving due to core insulation in double-leaf masonry. Final report. Jung, E.; Zumbroich, H. (Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.); Institut fuer Ziegelforschung e.V., Essen (Germany, F.R.); Bundesministerium fuer Raumordnung, Bauwesen und Staedtebau, Bonn (Germany, F.R.)). Dec 1986. 159p. (In German). NTIS (US Sales Only), PC A08/MF A01. Order Number DE88750514/JAW.

Double-leaf masonry with core insulation and without air cavity is a practicable and often used wall construction to reduce heat losses and thus to save energy. The requirement, however, is that the functioning of the entire wall is not deteriorated due to the lack of the air cavity. It was the aim of the investigation to examine the effects of core insulation under certain according to other research projects defined climatic conditions to which the external wall was exposed. There were made single tests with different core insulation materials, laboratory tests with larger walls as well as measurements in structures. In comparison to the standardized constructions so far used, the following statements can be made: The temperature load is not much higher; it is not necessary to reduce the distances of the expansion joints; the frost load of the facing bricks is stronger; the liability to efflorescence of the facing bricks possibly increases; the resistance against driving rain requires water-repellent insulating materials; the resistance against driving rain essentially depends on the construction. The application should be regulated by licences as the variety of core insulation materials and their placing involve considerable risks. With 27 refs., 71 figs..

8974 (BMFT-FB-T—86-239) Demonstration project Duisburg. Comparative investigation of various air conditioning systems in residential multiple dwellings. Final report. Truemper, H.; Hain, K.; Schmickler, F.P. (Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). Dec 1986. 141p. (In German). NTIS (US Sales Only), PC A07/MF A01. Order Number DE88750517/JAW.

This report describes the construction and trial service of the demonstration project. Following items will be described and explained by pictures: 1. General problems of ventilation of inside sanitary rooms and the way of ventilation of dwellings. 2. The residential buildings 'Duisburg-Neumuehl'. 3. The structural basis of heat consumption and the heat consumption itself. 4. The technics of heating and ventilation in the different dwellings and in the heating control center on the roof. 5. The selection and the construction of the sensors including the meteorological station. 6. The installation of the sensors in the heating control center on the roof. 7. The construction of the read-out station and the data collection system. 8. The programmes of protecting stored data and data evaluation. 9. First results of the trial service. 10. Outlook on further possibilities to evaluate measured dates. With 8 refs., 5 tabs., 48 figs..

8975 (CONF-871238—1) Comparison of a thermoelectric cooling system and a groundwater heat pump. Mei, V.C.; Chen, F.C.; Mathiprakasam, B. (Oak Ridge National Lab., TN (USA); Midwest Research Inst., Kansas City, MO (USA)). 1987. Contract AC05-84OR21400. 5p. NTIS, PC A02. Order Number DE88001753/JAW.

From Advanced energy systems session of the ASME; Boston, MA, USA (13 Dec 1987).

The performance of a groundwater thermoelectric (TE) heat pump system, based on today's state of the art TE materials, was calculated and compared with that of a conventional groundwater heat pump under the same water inlet temperature and flow rate. It was found that the TE system was quite competitive for cooling, particularly for groundwater temperatures below 18°C (64°F). The TE system performed poorly for heating mode operation. A cooling coefficient of performance (COP) of 6.4 could be realized by a properly designed TE system at a groundwater temperature of 13°C (55°F), compared with a COP of 4.35 for a conventional heat pump. For heating mode operation at the same water temperature, the TE system achieved a COP of 1.82, while the conventional heat pump performed at a COP of 3.72. TE systems for many buildings, where part of the areas require year-round cooling, can be a good alternative if groundwater of sufficiently low temperature is available. 8 refs., 5 figs., 3 tabs.

8976 (DOE/BP/11287—8) Cost analysis: The Hood River Conservation Project: Final report. Philips, M.; Khawaja, M.; Engels, D.; Peach, H.G. (Pacific Power and Light Co., Portland, OR (USA)). Apr 1987. Contract AC79-83BP11287. 78p. NTIS, PC A05/MF A01; 1; GPO Dep. Order Number DE88003273/JAW.

The Hood River Conservation Project (the Project) is a model electric energy conservation experiment designed to produce research on the conservation potential of super-weatherized residences in a limited geographical area in and around Hood River, Oregon. Project research will inform regional and local electrical energy planning groups, like the Northwest Power Planning Council, when conservation is included in long-range electrical power programs. This report discusses financial management of the Project, budget proposals, structures, modifications, accounting practices, and operations' costs (administration, marketing, and the computer system); the report analyzes retrofit measure costs - actual costs and estimated savings, and presents R & E expenditures and a projected R & E budget. 14 refs., 5 figs., 31 tabs.

8977 (DOE/BP/11287—18) Cooperation and community conservation: The Hood River Conservation Project. Hirst, E. (Oak Ridge National Lab., TN (USA)). Jun 1987. Contract AC79-83BP11287;AC05-84OR21400. 67p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE88003274/JAW.

The Hood River Conservation Project (HRCP) was intended to test the reasonable upper limits of a residential weatherization program. This research and demonstration project installed as many cost-justified energy-conservation measures in as many electrically heated homes in Hood River as possible. The measures were aimed at the building shell to reduce electricity use for space heating and at water-heating efficiency; no heating or water heating equipment was replaced. The Project had two parts. One was the weatherization of Hood River homes. Energy audits were performed and measures were installed between fall 1983 and the end of 1985. The other was the research and supporting data collection, which began a year before field activity started and continued for more than a year after measures were installed. This research was critical to the Project's success because HRCP was designed to provide information on the appropriate role of Pacific Northwest utilities in securing "conservation resources." This report summarizes both elements. Topics discussed include the background and objectives of HRCP, the Project's design and data resources, implementation and marketing efforts, household participation in the Project, weatherization measures installed, levels and changes in electricity use, Project cost-effectiveness, and several supplemental studies that

used HRCP data to address issues beyond the scope of the original Project. 58 refs., 20 figs., 22 tabs.

8978 (EUR—10523) Analysis of the performance of an air-water heat pump: Regulation of intrinsic performances: Final report. Martin-Neuville, H.; Reybillet, M.; Patureau, J.P. (Society Bertin et Compagnie, 78 - Plaisir (France). Div. Energetique). 1986. 141p. (In French). NTIS (US Sales Only), PC A07. Order Number DE88900241/JAW.

The objective of this project is to identify possible improvements for an electrical compressor heat pump of around 12 kW with air as a heat source. To test the heat pump under different "weather" conditions a test loop has been built. On the condenser side a water circuit with several capacities and heat exchangers simulates the thermal behavior of a 120 m^3 dwelling. A commercial domestic heat pump was extensively tested. The instantaneous performance of the heat pump agreed well with the data claimed by the manufacturer. The annual energy saving, however, was significantly lower due to the following: (1) loss of efficiency caused by defrosting cycles; (2) loss of efficiency due to inadequate thermal load matching between the heat pump and the house. It was shown that control of the condensing temperature can bring energy savings of 10%. This could probably also be realized by load matching with a compressor with a variable speed; and (3) the inefficient operation of components such as the evaporator and the condenser heat exchangers and the expansion valve. Optimization could lead to a considerable improvement. Modifications in the compressor are proposed which may lead to an increase of the efficiency to 60 to 70%. 11 refs., 61 figs., 7 tabs.

8979 (EUR—10552) Natural ventilation in large and multicelled buildings: Theory, measurement and prediction: Final report. Perera, M.D.A.E.S.; Walker, R.R.; Hathaway, M.B.; Oglesby, O.D.; Warren, P.R. (Building Research Establishment, Watford (UK)). 1986. 231p. NTIS (US Sales Only), PC A11/MF A01. Order Number DE88900076/JAW.

Methodologies for determining infiltration rates of large and complex buildings have been established. Solutions to this, hitherto, interactable problem have been obtained using a combination of theoretical and experimental studies. Comprehensive information regarding interzonal air movements might be obtained from experimental techniques using multiple tracer gases. Field measurements to determine interzonal flows were carried out in office buildings using automated measurement systems developed for this purpose. Theoretical and experimental work showed that is is probably sufficient to seed part of a complex building with a single tracer gas to measure the overall infiltration rate to a good approximation. Prediction models have been used to determine the effectiveness of draughtstripping windows on the energy consumption of an office building. The predicted infiltration rates compared well with measured values. Energy calculations showed that, for this particular building, draughtripping windows has reduced by 21% the seasonal gas consumption. 77 refs., 76 figs., 66 tabs.

8980 (EUR—10614) Solar assisted absorption or motor driven heat pump with earth seasonal storage: Part 1, Final report, 1 July 1982-30 June 1985. Lazzarin, R.M. (Metalux S.p.A., Musile di Piave (Italy)). 1986. 78p. NTIS (US Sales Only), PC A05/MF A01. Order Number DE88900191/JAW.

A plant composed of an energy roof, a seasonal earth storage and an absorption heat pump has been tested. The purpose was to study the behavior of the various components and their interaction. The surveys went on during two years. The following operations are considered: the charging of the earth storage by the energy roof and the working of an absorption heat pump connected either to the energy roof or to the earth storage.

8981 (EUR—10614-Pt.2) Solar assisted absorption or motor driven heat pump with earth seasonal storage: Part 2, Tables and figures: Final report. Lazzarin, R.M. (Metalux S.p.A., Musile di Piave (Italy)). 1986. 104p. NTIS (US Sales Only), PC A06/MF A01. Order Number DE88900226/JAW.

A plant composed of an energy roof, a seasonal earth storage and an absorption heat pump has been tested. The purpose was to study the behavior of the various components and their interaction. The surveys went on during two years. The following operations are considered: the charging of the earth storage by the energy roof and the working of an absorption heat pump connected either to the energy roof or to the earth storage. This volume contains all the figures and tables for the report. 77 figs., 24 tabs.

8982 (EUR—10663) Short Reference Years: Short weather data sets for faster simulations of solar energy systems and energy consumption in buildings. (Commission of the European Communities, Brussels (Belgium). Directorate General for Science, Research and Development). 1986. 49p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88900198/JAW.

A Test Reference Year (TRY) is a collection of hourly weather data for a specific location and for 365 days arranged as 8760 sets of simultaneous weather parameters. A Short Reference Year (SRY) is a similar collection of data for less than 365 days. SRYs are, like Test Reference Years (TRYs), used as input data for computer simulation of heating or cooling loads in buildings, solar energy systems, energy consumption and indoor climate. With a substantial reduction in computer time, SRYs give nearly the same results as TRYs. They are, however, less suited for determination of extreme temperatures, or simulation of solar systems with long storage times. SRYs have been produced for 29 locations in 7 member countries of the Community and are presented here. 4 refs., 1 fig., 31 tabs.

8983 (EUR—10725) Working fluids for sorption heat pumps: Summary report, 1 June 1981-30 September 1984. Bokelmann, H.; Ehmke, H.J. (Essen Univ. (Gesamthochschule) (Germany, F.R.). Inst. fuer Angewandtle Thermodynamik und Klimatechnik). 1986. 20p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88900203/JAW.

All working fluid pairs which are presently used in domestic absorption heat pumps have certain disadvantages. A systematic search for suitable working fluid pairs has therefore been carried out. Alcohols and amines as solutions and different halides, nitrates and thyocyanates as solvents have been studied. Five of the most promising systems (TFE-NMP, R123a-DTG, Methylamine-Gly, R22-DTrG and NH_3-$LiNO_3$/H_2O) were investigated in more detail. These investigations comprehended a complete measurement of the properties: vapor pressure, density and viscosity within the temperature range of interest. Also, calorific properties and vapor-liquid equilibria of some systems were determined. All measured data were correlated to equations which enabled a construction of diagrams for practical use. 9 figs.

8984 (EUR—10727) Energy saving by space heating in apartment buildings with installation of single-temperature electrical heat pumps using air as a heat source. Specht, O.; Mueller, P.; Klaus, H. (Vereinigte Elektrizitaetswerke Westfalen A.G. (VEW), Dortmund (Germany, F.R.)). 1986. 18p. (In German). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88900133/JAW.

The interaction between the heat pump and the building to be heated is very important for the performance of the total system and should be studied. VEW, Germany is investigating this interaction in two existing apartment buildings where electrical heat pumps with air as a heat source have been installed, which use existing radiators for the distribution of heat. The operation of the heat pumps is monovalent and with an outdoor temperature of -12°C the heat is delivered at 48°C. The two apartment buildings have 36 and 44 dwellings, respectively, and are heated with 4 and 5 heat pumps of 50 kW. A heat storage system has been installed to avoid operation of the electrical heat pumps at peak hours. It was found that the control of this system is difficult, but not impossible; a more sophisticated control system is required. The influence of the layout on the performance is very large. The seasonally averaged COP was 2 - 2,2. 5 figs., 2 tabs.

8985 **(EUR—10835) From stereo images to thermal models: A prototype system.** Peckham, R.J.; Cooper, D.; Green, C. (Commission of the European Communities, Ispra (Italy). Joint Research Centre; Ecotech Design Ltd., Scheffield (UK)). 1987. 75p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE88900187/JAW.

This report describes work carried out to investigate and develop techniques for making energy audits of existing buildings quicker, more reliable and cost effective. An essential part of any energy audit is the collection of the building geometrical data for input to a thermal simulation model. This is likely to be a time consuming process, not helped by the fact that in many buildings suitable plans will not be available. The Joint Research Centre of the European Communities (JRC) therefore decided to investigate the possibility of using images of the building to provide the required dimensional data for the building envelope. The use of stereo image pairs was proposed as a way of obtaining the three-dimensional geometry of the envelope, which could then be used in a thermal simulation model, or for solar shading calculations. This report describes the principles, theory and implementation of the prototype system which has been developed for making the complete link from stereo images to thermal simulation. The programs developed are listed in two appendices. Suggestions are made for further work to improve on this prototype system to make it more accurate and quicker to use. 10 refs., 10 figs., 3 tabs.

8986 **(EUR—10877) The effect of surrounding buildings and fluctuations in wind pressure differences on the ventilation of dwellings.** De Gids, W.F.; Phaff, J.C.; Crommelin, R.D. (Nederlandse Centrale Organisatie TNO, Delft). 1986. 15p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88900217/JAW.

This report consists in part of a deeper analysis of pressure differences measured in three dwellings. A further part of the report is a study of the effect of surrounding buildings on pressure distribution on basis of wind tunnel results. The report ends with a brief literature study on the effect of turbulence on ventilation. The salient results can be summarized as follows: (1) obstacles have a major effect on pressure distribution. The effect, expressed as the dimensionless pressure coefficient K, is on average 0.10 to 0.15; (2) the roughness of the surroundings up to a large distance can have an effect which, when expressed as the dimensionless pressure coefficient K, is 0.30; (3) in the processing of pressure data, linear averaging of pressure differences has almost no effect; and (4) theories on turbulent flow in cracks fail to account for the facts, because they assume ideal (i.e., smooth and regularly shaped) cracks.

8987 **(LBL—23179) Use of a general control simulation program to evaluate HVAC control stability.** Zhang, Xinbang; Warren, M.L. (Lawrence Berkeley Lab., CA (USA); Chinese Academy of Space Technology, Beijing. Eastern Scientific Instrument Factory). Aug 1987. Contract AC03-76SF00098. 31p. (CONF-880128—1). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88000476/JAW.

From ASHRAE winter meeting; Dallas, TX, USA (30 Jan 1988).

A general process engineering simulation program for a microcomputer is used to evaluate the response of a cooling system to changes in load, set point, and controller tuning parameters to better understand the control stability of a supply air cooling system used in the Mobile Windows Thermal Test (MoWiTT) Facility. A detailed system model is built out of standard components and is used to plot the steady state performance under different operating conditions. The response of the cooling coil output depends strongly on the transport delays. For a system with a linear control valve, the process gain of the cooling coil increases rapidly as the valve flow fraction decreases. A system which is stable at mid-range is shown to become marginally unstable at the low end of the control range. The application of both an equal percentage valve and reheat are shown to improve the control response of the system under low cooling load conditions. 6 refs., 12 figs., 2 tabs.

8988 **(LBL—23994) Residential energy consumption and expenditure patterns of low-income households in the United States.** Vine, E.L.; Reyes, I. (Lawrence Berkeley Lab., CA (USA)). Sep 1987. Contract AC03-76SF00098. 64p. (CONF-870564—5). NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE88003193/JAW.

From Socioeconomic energy research and analysis conference; Washington, DC, USA (21 May 1987).

The principal objective of this study is to compare poor and non-poor households with respect to energy consumption and expenditures, housing characteristics, and energy-related behavior. We based our study on an analysis of a national data base created by the US Department of Energy, the 1982-1983 Residential Energy Consumption Survey (RECS). RECS includes detailed information on individual households: demographic characteristics, energy-related features of the structure, heating equipment and appliances, recent conservation actions taken by the household, and fuel consumption and costs for April 1982-March 1983. We found a number of statistically significant (at the 0.05 level) differences between the two income groups in terms of demographics, heating/cooling/water heating systems, appliance saturation, the thermal integrity of their home, energy conservation behavior, energy consumption, energy expenditures, and the percentage of income spent on energy costs. For example, the non-poor used 22% more energy and paid 25% more money on utilities than the poor; however, the poor spent 20% more energy per square foot than the non-poor and spent about 25% of their income on energy expenditures, compared to 7% for the non-poor. These differences suggest different approaches that might be taken for targeting energy conservation programs to low-income households. Since the poor's "energy burden" is large, informational, technical, and financial assistance to low-income households remains an urgent, national priority. 13 refs., 26 tabs.

8989 **(ORNL/CON—238) Impact of the Hood River Conservation Project on electricity use for residential water heating.** Brown, M.A.; White, D.L.; Purucker, S.L. (Oak Ridge National Lab., TN (USA)). Oct 1987. Contract AC05-84OR21400. 78p. NTIS, PC A05/MF A01; 1; GPO Dep. Order Number DE88003646/JAW.

The Hood River Conservation Project (HRCP) was a two-year experiment in which residential customers were monitored for one year before and after the installation of conservation measures. Monitoring involved recording electricity use at 15-minute intervals for total consumption, space heat, and water heat. This report deals with the water-heater conservation results. The evaluation sought to: (1) determine electricity savings due to the installation of water-heater conservation measures; (2) quantify the savings attributable to each of the conservation measures (water-heater wrap, pipe wrap in the vicinity of the water heater, and low-flow showerheads); (3) quantify on- and off-peak savings; and (4) identify demographic and other determinants which correlate with savings. Levels of pre- and postretrofit water-heater electricity use are compared on an annual, seasonal, daily, and time-of-day basis. Estimates of the peak and off-peak savings of individual conservation measures rely on a duty cycle analysis of the 15-minute monitored data. Survey information is used in a correlation and regression approach to relate savings to customer demographics. 30 refs., 14 figs., 24 tabs.

8990 **(ORNL/CON—240) Hood River Conservation Project load analysis.** Stovall, T.K. (Oak Ridge National Lab., TN (USA)). Nov 1987. Contract AC05-84OR21400. 135p. NTIS, PC A07/MF A01; 1; GPO Dep. Order Number DE88003673/JAW.

As a part of the Hood River Conservation Project (HRCP), 314 homes were monitored to measure electrical energy use. The total electrical load, space heating load, water heating load (in about 200 homes), wood-stove heat output (in about 100 homes), and indoor temperature were monitored. Data were collected for one full year before and one full year after these homes were retrofit with conservation measures. Local weather information was also collected on a 15-min basis. This data base was used to evaluate the load savings attributable to HRCP. Two methods of weather normalization were used and showed close agreement. The weather-normalized diversified residential load savings on the Pacific Power

and Light system and Hood River area peak days were >0.5 kW/household. The average spring, summer, and fall savings were much smaller, <0.1 kW/household. The load factor for the diversified residential load decreased following the conservation retrofit actions. 11 refs., 40 figs., 13 tabs.

8991 **(ORNL/TM—10449) Life-cycle cost analysis of residential heat pumps and alternative HVAC [heating, ventilating, and air-conditioning] systems.** Mei, V.C.; Nephew, E.A. (Oak Ridge National Lab., TN (USA)). Sep 1987. Contract AC05-84OR21400. 72p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE88003701/JAW.

A simple methodology is presented for calculating the life-cycle cost of a residential heat pump, an electric furnace with a central air conditioner, and a gas furnace with a central air conditioner. The procedure described in this report involves application of the Annual Performance Factor computer model developed by the Oak Ridge National Laboratory. This model was used to calculate the annual energy consumption of each of the three systems for 117 different climatic locations within the United States for residential buildings of varying sizes and insulation levels. Nine example calculations are included in the report to better explain the calculational procedure. These examples show that the life-cycle costs of the residential heat pump are somewhat higher than those of the gas furnace with central air conditioner. However, the cost advantage of the gas-fired system is not decisive and could disappear in locations having low power costs or if relative fuel prices change. 17 refs., 5 figs., 11 tabs.

8992 **(PB—88-103619/XAB) Design guide for multi-flue chimneys. PSA (Property Services Agency) Civil Engineering Technical Guide No. 39.** (Property Services Agency, London (UK)). 1987. 63p. NTIS, PC E06/MF E06.

This Design Guide primarily covers the thermal and structural design of multi-flue chimneys serving conventional boilers and small hospital and laboratory incinerators and having heights less than 50m. Above 50m height, additional effects may come into prominence which are beyond the scope of the Guide. It is not intended to include chimneys serving industrial processes or large refuse incinerators. The Guide is intended to be comprehensive and is directed at civil, mechanical, and electrical and project engineers involved in the procurement of chimneys. It includes descriptions of the stages of a project, outline and detail design (including selection of materials), construction (including quality assurance), operation, and maintenance. Design examples are given for steel and concrete flue linings and support structures.

8993 **(PB—88-110911/XAB) Building technology publications, supplement 10: 1985-86. Final report.** Hockey, K. (National Bureau of Standards, Washington, DC (USA). Center for Building Technology). Sep 1987. 114p. (NBSIR—87/3631). NTIS, PC A06/MF A01.

See also report for 1984, PB—86-110905.

The report presents NBS' Center for Building Technology (CBT) publications for 1985-86. It is the tenth supplement to NBS' Building Technology Publications, and lists (CBT) reports issued during 1985-86. It includes titles of each CBT publication and those papers published in non-NBS media, keyword and author indexes, and general information and instructions on how to order CBT publications.

8994 **(TVA/OP/CEM—87/79) Energy Services for business and industry.** (Tennessee Valley Authority, Chattanooga (USA). Div. of Conservation and Energy Management). 1987. 14p. NTIS, PC A03/MF A01. Order Number DE88900178/JAW.

This brochure describes the Tennessee Valley Authority's (TVA's) programs that assist businesses and manufacturers in reducing their consumption of electricity. (JDH)

8995 **(TVA/OP/EDT—87/42) Shower bath economizer test program.** Hall, J.A. (Tennessee Valley Authority, Chattanooga (USA). Div. of Energy Demonstrations and Technology). Oct 1987. 41p. NTIS, PC A03/MF A01. Order Number DE88900177/JAW.

The shower bath economizer (SBE) is a simple counterflow heat exchanger which transfers heat from warm exiting shower drain water to cold incoming water. This report describes a comprehensive test program conducted by the Tennessee Valley Authority (TVA) to assess the technical and economic feasibility of the SBE. 11 figs., 6 tabs.

8996 **Very high efficacy electrodeless high intensity discharge lamps.** Johnson, P.D. (to Dept. of Energy, Washington, DC). US Patent 4,705,987. 10 Nov 1987. Filed date 3 Oct 1985. vp. Patent and Trademark Office, Box 9, Washington, DC 20232.

This patent describes an electrodeless arc lamp for forming a ring shaped plasma in a region therein during operation comprising a tube having a raised bottom center section, and an optically transparent outer jacket hermetically sealing the tube to protect the tube from cooling by convection. The raised center section rises centrally to form a ring shaped reservoir below the region in which the rig shaped plasma is formed to minimize wall cooling during operation of the lamp so that there is enhanced excitation near the center of the tube.

8997 **Magnetic refrigeration apparatus with belt of ferro or paramagnetic material.** Barclay, J.A.; Stewart, W.F.; Henke, M.D.; Kalash, K.E. (to Dept. of Energy, Washington, DC). US Patent 4,704,871. 10 Nov 1987. Filed date 3 Apr 1986. vp. Patent and Trademark Office, Box 9, Washington, DC 20232.

An about 12 to about 77K refrigeration apparatus is described comprising: a belt disposed in a loop around at least two wheels, with at least one wheel being a drive wheel; ferromagnetic or paramagnetic porous material carried by the belt; a magnetic field generating means disposed to produce a magnetic field surrounding at least one portion of the loop with the magnetic field essentially parallel to the direction of movement of the belt while the belt is in the magnetic field; means for driving the drive wheel; a fluid effective to transfer heat at temperatures between about 12 and about 85K; first and second higher temperature fluid manifolds directing the fluid from the first manifold adjacent to the first edge of the material; first a second lower temperature fluid manifolds directing the fluid from first manifold adjacent to the second edge of the material; at least one thermal load exchange means; a heat rejection exchange means; and means for pumping and transporting fluid from the heat rejection exchange means through the first and second higher temperature manifolds to the thermal load exchange means.

8998 **Heat pump ground coil analysis with thermal interference.** Mei, V.C. New York, NY; American Society of Mechanical Engineers (1987). 6p. (CONF-861211—). American Society of Mechanical Engineers, 345 East 47 St., New York, NY 10017.

From American Society of Mechanical Engineers winter meeting; Anaheim, CA, USA (7 Dec 1986).

Technical Paper 86-WA/SOL-6.

When two horizontal ground coils are buried in the same trench, one on top of the other, the total energy exchange between coils and ground increases drastically over that of a single coil for the same trench length. However, due to the thermal interference between the two coils, the overall performance of the two-coil trench is very difficult to determine. Traditionally this type of problem is handled by the line source mirror image approach. But this approach, due to the requirement of estimating the strength of the source, will result in extremely conservative ground coil design. This paper provides a detailed mathematical model to describe the operation of the two-coil system which can calculate more realistically the performance of the ground coils, which in turn could make the ground coil heat pump system more economically competitive with other heating and cooling systems. The effect of thermal interference is clearly shown in the calculated soil temperature profile. The effect of fluid inlet positions, from upper or lower coils, is also studied.

8999 **Vapor compression heat pump with temperature transformation.** Howe, L.A.; Radermacher, R. New York, NY; American Society of Mechanical Engineers (1987). 5p. (CONF-861211—). American Society of Mechanical Engineers, 345 East 47 St., New York, NY 10017.

From American Society of Mechanical Engineers winter meeting; Anaheim, CA, USA (7 Dec 1986).

Technical Paper 86-WA/HT-58.

A heat pump cycle is introduced, which allows heat pumping between two very high temperature levels, while the suction temperature of the working fluid vapor passing through the compressor is much lower. This effect of 'Temperature Transformation' is achieved by introducing a working fluid mixture and an unconventional cycle design. The new cycle allows the extension of heat pump applications to high temperature levels without encountering operating problems for conventional compressors. The performance of this cycle has been calculated and the results are presented and discussed.

9000 **Evaluation of a method for determining in-situ insulation values.** Reddy, C.S. New York, NY; American Society of Mechanical Engineers (1987). 8p. (CONF-861211—). American Society of Mechanical Engineers, 345 East 47 St., New York, NY 10017.

From American Society of Mechanical Engineers winter meeting; Anaheim, CA, USA (7 Dec 1986).

Technical Paper 86-WA/HT-74.

The determination of the insulation value (R-value) of walls or roofs of buildings from in-situ measurements poses difficulties because field conditions are seldom in steady state. In this paper, an averaging technique commonly employed to estimate R-values from dynamic thermal test data is presented. This technique is theoretically evaluated and several limitations are pointed out. The effects of climatic conditions during the test period, the location of the sensors used to measure the heat flux, and the thermal mass of the system under consideration, on the predicted results, are investigated qualitatively. It is shown that the R-values determined by the method may not always agree with the values predicted by steady state methods.

3202 Transportation

REFER ALSO TO CITATION(S) 9268, 9269, 9270, 9271, 9272, 9273, 9274, 9275

3203 Industry And Agriculture

REFER ALSO TO CITATION(S) 8378, 8390, 8994

9001 **(CONF-870710—3) Relative importance of economic and engineering factors influencing industrial cogeneration.** Rose, K.; McDonald, J.F. (Argonne National Lab., IL (USA)). 1987. Contract W-31109-ENG-38. 14p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88002952/JAW.

From International Association of Energy Economists conference; Calgary, Canada (6 Jul 1987).

Industrial cogeneration - the process of generating both electricity and heat from a single energy source at an industrial plant - has been of interest as a way to conserve energy and to decentralize electricity production. We developed an economic model to examine the relative importance of several key economic and engineering factors that firms consider when deciding whether to cogenerate. The model determines the amount of cogenerated electricity produced and the total electricity used by a plant as a function of economic and engineering factors that influence a plant's demand for and marginal cost of electricity. The analytical results suggest that policy actions concerning industrial cogeneration turn on electricity prices and external factors that affect the plant's marginal cost of cogenerating. The buy-back rate, considered by some to be an important factor in determining the amount of cogeneration, was found to be important in determining the amount of cogenerated power only when the plant meets certain economic and engineering conditions. 10 refs., 3 figs., 4 tabs.

9002 **(DOE/CE/40606—T5) Physical properties of kraft black liquor: Summary report, Phases 1 and 2.** Fricke, A.L. (Florida Univ., Gainesville (USA); Maine Univ., Orono (USA)). Sep 1987. Contract AC02-82CE40606;FG02-85CE40740. 310p. NTIS, PC A14/MF A01; 1; GPO Dep. Order Number DE88002991/JAW.

Since 1981, a research program has been in progress to determine the physical properties of kraft black liquors and to develop methods for reduction of data and correlation of properties with pumping conditions. The basic premise that has been used to direct the research program is that kraft black liquor behaves as a polymer solution, particularly at high solids, and that the behavior is dominated by the characteristics of the lignin present. This premise is proving to be correct, and the principles that follow from this premise are proving to be successful for data reduction and correlation. The research has been a complex program involving experimental pulping, chemical analysis, lignin separation and characterization, thermal analysis, rheological measurements, and considerable equipment and methods development. Due to the complexity of the program, the unforeseen need to expend a great deal of effort in development of experimental techniques for analysis, and the fact that our liquors proved to be unstable at high temperatures and solids, all of the original objectives could not be accomplished. However, our program has added substantially to the body of knowledge of physical properties of black liquor. Our results indicate that the goal of developing correlations for physical properties of kraft black liquor is practical and can be realized through extension of the present work.

9003 **(EUR—10303) Application of engine-driven heat pumps to grain drying with refrigerated storage: Final report.** Cunney, M.B.; Williams, P.A.; Marley, S.J. (Foras Taluntais, Dublin (Ireland)). 1985. 146p. NTIS (US Sales Only), PC A07/MF A01. Order Number DE88900197/JAW.

An engine driven heat-pump unit was built and used in a barley drying/storage system. Chilled air was used to prolong the storage life of undried grain, while air heated by the engine and heat-pump was used to dry the grain. When the unit was not chilling grain, exhaust air from the dryer was recycled over the evaporator to the inlet of the heating section to give higher drying temperatures and improved drying efficiency. In this way it was proposed to defray the increased capital cost of a heat-pump dryer over a longer season than with conventional dryers. Temperatures, pressures and fuel and refrigerant flows were recorded using microcomputer-based data logging system. Specific energy consumption was 4.7 to 5.1 MJ kg^{-1} of water evaporated in open-cycle drying. This was improved to 4.0 MJ kg^{-1} under full recirculation. Primary Energy Ratios of 1.1 to 1.2 and refrigerant cycle COP's of 4.1 to 4.6 were observed. The low PER's arose from using a petrol engine with a low thermal efficiency. The existing rig gave energy savings of 10 to 15% over conventional drying systems; with an efficient diesel-engine drive this could be raised to 47 to 55%. This would make the unit a viable economic alternative to conventional drying, especially if its size were increased. 23 refs., 24 figs., 34 tabs.

9004 **(PB—88-112842/XAB) Opportunity evaluation for gas-engine and gas-turbine cogeneration/absorption refrigeration systems in industrial applications. Topical report, February-December 1986.** Moyer, C.B.; Nicholson, J.A.; Overly, P.T. (Acurex Corp., Mountain View, CA (USA)). Dec 1986. 110p. (ACUREX-FR—87-122-ESD). NTIS, PC A06/MF A01.

Installed industrial refrigeration (not counting space conditioning) capacity in the U.S. is approximately 3,000,000 tons. Average electrical use for industrial refrigeration is about 1,000,000 kW. Agricultural industries account for 90% of the refrigeration use. Natural-gas fuel cogeneration can reduce refrigeration costs, as shown by an analysis of four candidate cogeneration systems utilizing gas engines and gas turbines. The economic benefits depend on the local price for electricity and gas, but for large areas of the U.S. the pre-tax rate-of-return on investment in engine and turbine cogeneration equipment would be in the range 20 to 40%. The economic attractiveness of gas-fired cogeneration would be substantially improved by reduced costs for engines and for ammonia-absorption systems.

9006 Multivalent ion removal from Kraft black liquor by ultrafiltration. Kirbawy, S.A.; Hill, M.K. (Weyerhaeuser Co., Federal Way, WA 98477). *Industrial and Engineering Chemistry Research;* 26: No. 9, 1851-1853(Sep 1987).

Kraft black liquor (KBL) was ultrafiltered into permeate and retentate fractions. Whereas Na and K were concentrated in permeate solids, many higher valence ions were disproportionately found in retentate solids. Those elements concentrated included Ca, Mg, Al, and Fe. Si was less dependably retained. The retentate/permeate ratio of Ca, based on dry solids, was as little as 1.6 for a low-Ca northern softwood KBL and as high as 7.6 for a high-Ca southern hardwood KBL. Polysulfone ultrafiltration (UF) membranes of 50 000 molecular weight cutoff (MWCO) concentrated multivalent elements to a lesser extent than did 6000 or 20 000 MWCO membranes. A nylon microfiltration membrane (0.5-μm pore size) concentrated multivalents to a greater extent during a 60°C run than it did when a run was made at 75°C. Kraft white liquor had only a small tendency to concentrate multivalents in the retentate, especially when care was taken to remove all carbon particulates.

9008 Fundamental aspects of key issues in hazardous waste incineration. Tsang, W. New York, NY; American Society of Mechanical Engineers (1987). 6p. (CONF-861211—). American Society of Mechanical Engineers, 345 East 47 St., New York, NY 10017.

From American Society of Mechanical Engineers winter meeting; Anaheim, CA, USA (7 Dec 1986).

Technical Paper 86-WA/HT-27.

The incineration of hazardous waste is considered from the point of view of its important chemical reactions. The authors begin with a brief review of their earlier work on destruction mechanisms and expand it by allowing for regions where pyrolytic reactions are of importance. They then discuss the quantitative relationship between destruction efficiency and the appropriate rate constants for hazardous waste destruction. This leads into considerations of the products of incomplete combustion and the authors describe in qualitative terms the type of compounds that can be expected. The concept of surrogates is discussed. They consider recent results on OH attack on organics near incineration conditions. When this is compared with levels of CO usually observed in various types of incinerators. The authors conclude that there is a high probability that the organics in the incineration effluent stream are formed by pyrolysis mechanisms. Finally, they suggest a number of measures for validating proper incinerator operation.

9007 The implications of air quality planning programs on regional energy use. Hunsaker, D.B. Jr. (Oak Ridge National Lab.). pp 222-228 of Proceedings of the 30th annual technical meeting on environmental integration technology today for a quality tomorrow. Mt. Prospect, IL; Institute of Environmental Sciences (1984). (CONF-8405403—).

From 30. annual technical meeting on environmental integration technology today for a quality tomorrow; Orlando, FL, USA (1 May 1984).

A topic of much debate in recent years has been the potential conflict between protection of the environment and the conservation of nonrenewable imported energy resources. The goals of air pollution control programs can be realized more readily if they are compatible with energy conservation goals. This study attempts to give insight on the above issue by conducting a retrospective analysis of the energy consequences of implementing the 1979 San Francisco Bay Area Air Quality Plan. The energy consumed or saved on a regional basis through compliance with pollution control actions stemming from the Plan is estimated, and is then compared to the total energy consumed during the same time frame by the appropriate sector of the economy. For example, industry compliance with regulations related to the new source review policy action resulted in an estimated regional energy penalty equivalent to less than 1% of the energy consumed by the commercial and industrial sectors of the Bay Area economy. On the whole, the 1979 Plan was estimated to produce a slight overall energy savings, primarily due to hydrocarbon emission controls on stationary and mobile sources. Places in the air quality regulatory framework that address energy issues are identified; recommendations are made for modifying the framework to encourage the consideration of energy issues while still meeting the goals of the Clean Air Act.

3206 Municipalities And Community Systems

REFER ALSO TO CITATION(S) 8402, 8763, 9006

9008 (CONF-870621—3) Recent state legislation that encourages development of DHC [district heating and cooling] systems. Kier, P.H.; Meshenberg, M.L. (Argonne National Lab., IL (USA)). 1987. Contract W-31109-ENG-38. 7p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88003082/JAW.

From 78. International District Heating and Cooling Association conference; Baltimore, MD, USA (21 Jun 1987).

While studying how state legislation affects the development of district heating and cooling (DHC) systems, research uncovered more than forty recently-enacted statutes in nearly thirty states that in some way encourage the development or operation of DHC systems. The content of these pieces of legislation indicates the variety of potential legal/regulatory problems that confront DHC systems and the legislative approaches to resolving those problems. These statutes do one or more of the following: exempt certain thermal energy producers or DHC systems from public utility regulation; provide for limited public utility regulation of some DHC systems; authorize state agencies to make loans to DHC systems or thermal energy producers; enable public entities to own DHC systems or thermal energy production facilities; or enable public entities to purchase from DHC systems. 1 tab.

9009 (SFB—210-T-27) Computational evaluations of buoyancy effects in settling tanks. Adams, E.W.; Stamou, A.I. (Karlsruhe Univ. (T.H.) (Germany, F.R.). Sonderforschungsbereich 210 Stroemungsmechanische Bemessungsgrundlagen fuer Bauwerke). Jan 1987. 23p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88750520/JAW.

The paper compares measured concentration and velocity profiles for the tertiary sewage treatment basin at Aelmhult, Sweden with the results of computations using the k-ϵ model of turbulence. The effect of including buoyancy forces in the computer program on the calculated flow field is shown to be quite strong. Without the inclusion of the buoyancy force terms in the momentum equations, the flow field showed unidirectional flow throughout the tank after a short separation region near the inlet. The results of the calculations including the buoyancy force terms, as in the real basin, had a large separation region occupying the entire top half of the tank. While the computations including the effects of buoyancy showed good qualitative agreement with the measured profiles, quantitative agreement was not as good.

33 ADVANCED AUTOMOTIVE PROPULSION SYSTEMS

9010 (DOE/CE—0199) Ninth annual report to Congress on the Automotive Technology Development Program. (USDOE Assistant Secretary for Conservation and Renewable Energy, Washington, DC. Heat Engine Propulsion Div.). 17 Sep 1987. 34p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88003742/JAW.

This report discusses DOE sponsored research in the area of automotive propulsion technology for the fiscal year 1987. Topics included are: (1) development of advanced heat engines with 30% improvement in fuel economy; (2) development of diesel engines with 30% improvement in fuel economy; (3) structural ceramics and advanced materials research; (4) establishment of a technology base for use of alternative fuels; (5) research and development of gas turbine, Stirling, and adiabatic diesel engines. (BCS)

3301 Internal Combustion Engines

REFER ALSO TO CITATION(S) 9075, 9075

9011 (DOE/CE/15327—T1) Diesel engine regenerative filter development: Quarterly progress report No. 1. Lefkowitz, L. (Compix Enterprises, Inc., Latham, NY (USA)). 3 Aug 1987. Contract FG01-87CE15327. 13p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE87013091/JAW.

This report describes a filter used to remove soot from diesel engine exhaust. During the present reporting period, a bench model of the filter was designed and built. The filter consists of ceramic tubes surrounded by an electric heater. Experiments are planned to measure the effectiveness of the device before the full-size unit is built. (JDH)

9012 (NP—8750522) Ceramic components for Otto engines and diesel engines. Final report. Stingl, P.; Steiner, M. (Audi NSU Auto Union A.G., Neckarsulm (Germany, F.R.)). Sep 1986. 96p. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88750522/JAW.

Within the scope of the BMFT research project 'TV 8030/8360' the suitability of numerous ceramic components out of Al/sub 2/TiO/sub 5/, Si/sub 3/N/sub 4/ and SiC was tested for the use in motors or turbochargers in the time from 1.10.80 until 30.9.85. The main intention at Hoechst CeramTec was the development of a reproducable production method for motor components out of aluminium-titanate, suitable for a little series. Until the end of the project this intention was achieved. For the production of slip cast components (portliners) a pilote line was established. The capacivity of production amounts to about 4000 parts per week. Furthermore emphasis in developing was put on the production of ceramic turbochargers. It is true that, up to the end of the project, the component strength for this part, which was demanded by the user, could not be achieved; yet a clear rise in strength (800 MPa) was reached by an additional hot isostatic pressing of the RBSN.

9013 (ORNL/Sub—85-97367/1) Fuel nitrogen conversion in a supercharged spark ignition engine. Hodgson, J.W.; Denny, J.C. (Tennessee Univ., Knoxville (USA). Dept. of Mechanical and Aerospace Engineering). Oct 1987. Contract AC05-84OR21400. 133p. NTIS, PC A07/MF A01; 1; GPO Dep. Order Number DE88003739/JAW.

The prospect of future fuels' containing more nitrogen than existing fuels, coupled with the possibility that automobile manufacturers may resort to increased use of supercharging, has motivated this study. The objective is to determine whether high levels of fuel-bound nitrogen lead to increased emissions of nitric oxide in a supercharged engine. The study was conducted in three phases. Phase 1 involved determining the nitric oxide (NO) emissions for various values of compression ratio, intake manifold pressure, air-fuel ratio, and fuel-nitrogen level. Phase 2 involved determining the effect of the base fuel aromatic content on the NO emissions and Phase 3 tested Solvent Refined Coal (SRC), a synthetic gasoline containing no nitrogen. For each phase, the engine was run at 1800 rpm and MBT (Minimum for Best Torque) spark timing. The fuel-nitrogen levels were created by doping the base fuel with pyridine. Results are presented in terms of the mass flow rate of nitrogen in the NO per mass flux of fuel (MNOMF) versus equivalence ratio. The fraction of the fuel nitrogen converted to nitric oxide was also calculated for Phase 1 data. In evaluating the results, it was found that the fuel nitrogen level had less effect on the NO emissions than the effects one would expect from routine variations in inlet air humidity. In Phase 2, it was found that the aromatic content of the base fuel had no measured effect on NO emissions. In Phase 3, the SRC fuel gave values of NO that were similar to those obtained from the other fuels tested. 33 refs., 19 figs., 7 tabs.

9014 CARS diagnostics of internal combustion engine processes. Lucht, R.P. (Sandia National Labs., Combustion Research Facility, Livermore, CA 94550). pp 232 of Proceedings of the conference on lasers and electro-optics. Piscataway, NJ; IEEE Service Center (1987). (CONF-870401—).

From OSA/IEEE conference on lasers and electro-optics (CLEO '87); Baltimore, MD, USA (27 Apr 1987).
Technical Paper THH3.

Broadband coherent anti-Stokes Raman scattering (CARS) measurements of unburned gas temperatures in a knocking spark ignited engine have been performed. The collisional narrowing model of a previous author was used. CARS measurements of the temperature profile near a chamber wall in the burned gas region were also performed. The nitrogen spectrum acquired just prior to autoignition and the theoretic fit are discussed.

3302 External Combustion Engines

REFER ALSO TO CITATION(S) 9010

9015 (DOE/NASA—0032-28) Automotive Stirling engine: Mod II design report. Nightingale, N.P. (Mechanical Technology, Inc., Latham, NY (USA)). Oct 1986. Contract AI01-85CE50112. 56p. (NASA-CR—175106). NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE88003236/JAW.

The design of an automotive Stirling engine that achieves the superior fuel economy potential of the Stirling cycle is described. As the culmination of a 9-yr development program, this engine, designated the Mod II, also nullifies arguments that Stirling engines are heavy, expensive, unreliable, and demonstrate poor performance. Installed in a General Motors 1985 Chevrolet Celebrity car, this engine has a predicted combined fuel economy on unleaded gasoline of 17.5 km/L (41 mi/gal) - a value 50% above the current vehicle fleet average. The Mod II Stirling engine is a four-cylinder V-drive design with a single crankshaft. The engine is also equipped with all the controls and auxiliaries necessary for automotive operation. 35 figs.

3303 Electric-powered Systems

9016 (ANL/CNSV-TM—190) User's guide to DIANE: A microcomputer program for modeling battery performance in electric vehicles. Marr, W.W.; Walsh, W.J.; Symons, P.C. (Argonne National Lab., IL (USA)). Sep 1987. Contract W-31109-ENG-38. 42p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88003713/JAW.

A microcomputer program (DIANE) has been developed to model changing electric-vehicle (EV) performance capability as a function of operating history. The principal objective of this software package is to enable the accurate prediction of EV performance on the basis of laboratory bench data for batteries. The model provides a second-by-second simulation of battery voltage and current for any specified power/time profile and includes possible "recuperation" effects during vehicle rest periods. The electric vehicle is simulated by algorithms that relate the battery power required for a particular maneuver to the corresponding velocity/time profile. The resulting power/time profile is then compared with the battery capability. Battery capability is simulated by an algorithm relating the battery voltage and the current being withdrawn. Depth-of-discharge and aging effects are computed during simulated driving over a user-selected driving pattern, and the performance capability of the EV is determined periodically. The simulation continues until the battery capability is insufficient to meet the mission requirements set by the user. DIANE is a user-friendly, interactive microcomputer software package programmed in FORTRAN. It includes a default data file for a candidate battery, and a sample calculation is included in the software package to illustrate the operation of the program. 8 refs., 1 fig., 3 tabs.

3306 Vehicle Design Factors

9017 (EUR—10551) Composite/metal jointing technology for vehicle weight reduction: Summary report. Livey, D.T.; McCarthy, J.C. (UKAEA Atomic Energy Research Establishment, Harwell). 1986. 21p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88900228/JAW.

A comprehensive program of work was carried out on the development and validation of design procedures for adhesively bonded composite-metal joints. Two computer programs were developed for the design of tubular joints (e.g., driveshafts) and sheet-sheet joints (e.g., for bodywork) which take account of the extensive yielding of adhesives in the prediction of joint stresses. Associated materials, testing and assessment work was also undertaken including: (1) the determination of adhesive and joint mechanical properties required for the validation of the design stress analyses and to establish a materials data base for future use in joint design; (2) the development of test methods to provide more reliable and accurate data on adhesive properties; (3) evaluation of environmental durability and surface treatment combinations on joint components; (4) testing of full size component joints for drive shafts and hatchback doors for both static and fatigue loading and tests at temperature extremes; and (5) preliminary assessment of non-destructive testing techniques. 1 ref., 4 figs., 1 tab.

3308 Alternative Fuels

REFER ALSO TO CITATION(S) 9013

9018 (CONF-870366—2) A summary of economic and engineering research at Argonne National Laboratory supporting a transition to methanol fuels for transportation. Larsen, R.P.; Santini, D.J. (Argonne National Lab., IL (USA)). 1987. Contract W-31109-ENG-38. 11p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88003105/JAW.

From Alternative energy in the midwest; Rosemont, IL, USA (18 Mar 1987).

The US transportation system is in the early stages of a historically common but difficult period involving a major change in transportation fuels. As in the past, transportation in the United States has become excessively dependent on a single fuel whose domestic reserves are being exhausted. A transition from petroleum to an alternative fuel that will eventually be suitable for a significant part of the US transportation system should begin on a large scale by the mid-1990s. This transition must be planned carefully to avoid rapidly increasing fuel prices and overdependence on petroleum from foreign fuel sources. This paper draws from research at Argonne National Laboratory (ANL) and summarizes the growing evidence supporting methanol as the preferred alternative transportation fuel of the future. It describes reasons for a transition to methanol, the prevailing attitudes in industry and government toward that fuel, and the initial results of the ANL Cold Weather Methanol Test Fleet demonstration program. The interpretations of the attitudes of industry and government representatives are based on feedback gathered at major professional conferences devoted to advanced transportation technology and alternative fuels. 12 refs., 2 figs.

9019 (CONF-871142—6) A review of methanol vehicles and air quality impacts. Moses, D.; Saricks, C. (Argonne National Lab., IL (USA)). 1987. Contract W-31109-ENG-38. 7p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE88002846/JAW.

From International fuels and lubricants meeting and exposition; Toronto, Canada (2 Nov 1987).

In the quest for measures to reduce ambient ozone and carbon monoxide levels to the degree required by revised State Implementation Plans (SIPs), non-attainment areas are investigating and committing to incentive programs for accelerated penetration of methanol- and flexible-fueled motor vehicles into the regional fleet. In this paper we examine if the premises for these commitments are sound; if, in fact, incontrovertible evidence is in hand to assure that the net air quality effect of replacing gasoline- and diesel-powered vehicles with methanol- and flexible-fuel units will be positive; and whether such positive effects, even if they can be proved, will occur in a time frame that will be useful or even relevant to the developers of SIP revisions. Our conclusions, based upon emission rate and failure mode information now available, are that optimism on either front (net positive air quality effect or availability of production methanol-compatible units in the near term) is premature, and that the case for methanol today should probably be founded on the desirability of national energy security, rather than on any assumed local or regional environmental benefit needed for SIP compliance. 7 refs., 1 tab.

35 ARMS CONTROL

3501 Policy, Negotiations, And Legislation

9020 (UCRL—97565) The purposes, achievements, and priorities of arms control. Brown, P.S. (Lawrence Livermore National Lab., CA (USA)). Sep 1987. Contract W-7405-ENG-48. 21p. (CONF-870949—1). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88003374/JAW.

From Technology, the arms race, and arms control; Livorno, Italy (25 Sep 1987).

Arms control purposes include strengthening the framework of deterrence and reducing the threat of the use of nuclear weapons, reducing the dangers of attack and accidental nuclear war, and allowing more resources for the civilian economy. The paper briefly describes achievements in arms control since World War II. These include the Limited Test Ban Treaty (LTBT), Nonproliferation Treaty (NPT), Anti-Ballistic Missile Treaty (ABMT)-SALT I, SALT II, Threshold Test Ban Treaty (TTBT), Peaceful Nuclear Explosions Treaty (PNET), and Nuclear-Free Zones treaties. The author also discusses his views on what the priorities of arms control activities should be. (ACR)

3503 Verification

REFER ALSO TO CITATION(S) 9448

36 MATERIALS

REFER ALSO TO CITATION(S) 10381

9021 (CEA-LETI-RA—1986) Progress report 1986. (CEA Centre d'Etudes Nucleaires de Grenoble, 38 (France). Lab. d'Electronique et de Technologie de l'Informatique). 1987. 134p. (In French). NTIS (US Sales Only), PC A07/MF A01. Order Number DE88751726/JAW.

The principal out standing events are the new SOI way, the MOS association, the gamma camera, the medical tomography, the positron emission camera, the magnetic heads and disks, the infrared imaging device, the CCD, the high energy-tomography for non destructive control, Eidomatix, visualisation, and compoments hardened under radiation.

9022 (CONF-8703208—1) Pulsed neutron diffraction in special sample environments. Jorgensen, J.D. (Argonne National Lab., IL (USA)). May 1987. Contract W-31109-ENG-38. 27p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88003104/JAW.

From Conference on chemical crystallography with pulsed neutrons and synchrotron radiation; Algarve, Portugal (17 Mar 1987).

Neutron diffraction is a powerful tool for structural studies of samples in special sample environments because of the high penetrating power of neutrons compared to x rays. The neutrons readily penetrate special sample containers, heat shields, pressure vessels, etc., making it unnecessary in most cases to compromise the effectiveness of the sample environment system by providing windows for the incident and scattered neutrons. Pulsed neutrons obtained from an accelerator-based pulsed neutron source offer the additional advantage that many diffraction experiments can be done at a single, fixed scattering angle by the time-of-flight technique. In the fixed-angle scattering geometry, shielding and collimation can be optimized in order to access the largest possible sample volume with neutrons while completely avoiding scattering from the surrounding sample vessel. Thus, the data are free from unwanted background scattering. In this paper, the basic principles of neutron diffraction in special sample environments are discussed and examples of apparatus used for neutron diffraction measurements at low

temperature, high temperature, and high pressure are presented. 36 refs., 15 figs., 3 tabs.

9023 **(LBL—22075) Center for Advanced Materials: Annual report, 1986.** (Lawrence Berkeley Lab., CA (USA)). Apr 1987. Contract AC03-76SF00098. 108p. NTIS, PC A06/MF A01; 1; GPO Dep. Order Number DE88000686/JAW.

Individual projects are processed separately for the data bases. Research areas were: Electronic Materials, Polymers and Composites, Instrumentation for Surface Science, Surface Science and Catalysis, Ceramic and Metal Interfaces, Structural Materials. (CBS)

9024 **(ORNL/FMP—87/3) Consolidated bibliography of publications of the Advanced Research and Technology Development (AR and TD) Fossil Energy Materials Program, October 1, 1979-April 30, 1987.** Carlson, P.T. (comp.). (Oak Ridge National Lab., TN (USA)). Sep 1987. Contract AC05-84OR21400. 128p. NTIS, PC A07/MF A01; 1; GPO Dep. Order Number DE88003645/JAW.

The objective of the Advanced Research and Technology Development (AR and TD) Fossil Energy Materials Program is to conduct long-range research and development that addresses the materials needs of fossil energy systems, including materials for coal preparation, coal liquefaction, coal gasification, heat engines and heat recovery, coal combustion systems, fuel cells, magnetohydrodynamics, and oil shale processing. Materials research that addresses materials problems generic to several fossil energy technologies is emphasized. Current research projects are concentrated in the following thrust areas: (1) Structural Ceramics, (2) Alloy Development and Mechanical Properties, (3) Corrosion and Erosion of Alloys and Refractories, and (4) Assessments and Technology Transfer. This consolidated bibliography of publications of the AR and TD Fossil Energy Materials Program covers those publications issued under the auspices of the Program from October 1, 1979, through April 30, 1987. It is the intent to list only those publications that can be obtained by a researcher through relatively normal channels. In addition, the publications listed are full-length, complete reports. The publications have been limited to (1) topical reports, (2) open literature publications in refereed journals, (3) full-length papers in published proceedings of conferences, (4) full-length papers in unrefereed journals, and (5) books and book articles. Oral presentations, progress reports, management reports, letter reports, abstracts, and summaries have not been included.

9025 **(ORNL/TM—10242) Advanced Research and Technology Development Fossil Energy Materials Program implementation plan for fiscal years 1987 through 1991.** Judkins, R.R.; Carlson, P.T. (comps.). (Oak Ridge National Lab., TN (USA)). Sep 1987. Contract AC05-84OR21400. 149p. NTIS, PC A07/MF A01; 1; GPO Dep. Order Number DE88003689/JAW.

This program implementation plan for the Department of Energy Advanced Research and Technology Development (AR and TD) Fossil Energy Materials Program reviews the technical issues and the materials research and development needs of fossil energy technologies. The status and plans for research and development activities in the AR and TD Fossil Energy Materials Program to meet those needs are presented. Detailed information about these plans is provided for FY 1987 through FY 1989, and long-range plans are described for FY 1990 and FY 1991.

3601 Metals And Alloys

REFER ALSO TO CITATION(S) 8383, 8384, 8385, 8385, 8411, 8483, 8484, 8484, 8485, 8514, 8515, 8532, 8595, 8778, 8778, 8779, 8786, 8790, 8790, 8799, 8805, 8805, 8831, 8892, 8898, 8898, 8899, 8932, 8932, 8972, 9108, 9146, 9183, 9229, 9325, 9376, 10323, 10331, 10332, 10488, 10491, 10491, 10494, 10495, 10496, 10498, 10507

9026 **(AERE-G—3450) Corrosion studies on HGW-canister materials for marine disposal. Progress report for 1984/1985.** Taylor, K.J.; Bland, I.D.; Smith, S.; Marsh, G.P. (UKAEA Atomic Energy Research Establishment, Harwell. Materials Development Div.). Mar 1986. 47p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88750706/JAW.

Results are presented from theoretical and experimental work undertaken to investigate and assess the general corrosion behaviour of carbon steel canister/overpacks for heat generating nuclear waste under marine disposal conditions. The mean general corrosion rates of carbon steels, determined experimentally by polarisation resistance measurements on specimens in on-going immersion tests, are between 65-124 $\mu m\ yr^{-1}$ at 90°C and 5-25 $\mu m\ yr^{-1}$ at 25°C and are tending to increase with time. Anomalously high corrosion rates are being indicated by similar tests at 50°C. It is not clear what reliance should be placed on the polarisation resistance results, however, and therefore no conclusion will be drawn until the tests are dismantled and inspected in the 1985/86 programme. Tests with γ-radiation on forged carbon steel specimens immersed in deaerated seawater at 90°C show that this causes an acceleration of corrosion rate at the three dose rates down to at least 300 $R\ h^{-1}$. Deep ocean sediment from GME also accelerates the corrosion rate of carbon steel in deaerated seawater both with and without γ-radiation. The effect diminishes with continued exposure and is thought to be due to the presence of either an additional so far unidentified oxidising agent or some component which reduces the corrosion protection afforded by the build up of a corrosion product layer. Acquisition of improved electrochemical kinetic data for the mathematical model is now complete, and the model has been run for temperatures of 25 and 90°C, where it predicts steady corrosion rates of 19.3 and 180 μm/yr. The model has shown that the rate of attack is not influenced greatly by the depth of sediment, and that the component of corrosion caused by radiation is of the order of 7 mm over 1000 years.

9027 **(AERE-M—3537) List of underlying and applied oxidation reports published between January 1977 and January 1986.** Atkinson, H.V. (UKAEA Atomic Energy Research Establishment, Harwell. Materials Development Div.). Mar 1986. 10p. H.M. Stationery Office, London, price Pound 4.00.

The paper contains a list of reports and published papers from the underlying oxidation programme of research at Harwell, United Kingdom, published between January 1977 and January 1986. The references concern underlying oxidation research, and applied studies of the oxidation of metals and alloys. (U.K.).

9028 **(AERE-R—10937-Rev.) FACSIMILE code for calculating void swelling including microchemical effects; version VS7.** Murphy, S.M.; Bullough, R.; Windsor, M.E.; Wood, M.H. (UKAEA Atomic Energy Research Establishment, Harwell. Theoretical Physics Div.). Jan 1986. 67p. H.M. Stationery Office, London, price Pound 6.00.

This report describes the seventh in a series of computer codes to model void swelling and creep during irradiation of reactor structural materials. The various codes use the chemical rate theory at different levels of complexity. The present version, VS7, calculates void swelling only and includes recently derived expressions for the network dislocation sink strengths and an improved transmutation gas model. In addition, the code includes two species of solute atoms which act as trapping sites for vacancies and interstitials respectively. A simple diffusion model describes the migration of these solute atoms to precipitates and the subsequent growth of these precipitates. There is also an option for these precipitates to be associated with cavities, and the enhanced growth of these cavities in comparison with cavities isolated in the matrix can also be studied.

9029 **(AERE-R—12121) Computer code to calculate radiation-induced segregation in concentrated ternary alloys.** Perks, J.M.; Marwick, A.D.; English, C.A. (UKAEA Atomic Energy Research Establishment, Harwell. Materials Development Div.). Jun 1986. 42p. HMSO, London, price Pound 5.00.

A program to calculate the major element segregation in irradiated concentrated binary and ternary alloys has been modified and further developed. The program predicts that significant segregation occurs near grain boundaries in a ternary alloy with the same major element composition as a Fe-20Cr-25Ni-Nb stainless steel used in thermal reactors. The effects of differing irradiation conditions have shown that significant segregation occurs at low doses (<0.1 dpa) but reaches a steady state after approx. 10 dpa. The model predicts a strong dependence of segregation on the irradiation temperature with the segregation reaching a maximum between 300 and 500°C for irradiation conditions typical of a thermal reactor. A modified version of the program predicted the thermal de-segregation after a post-irradiation anneal. Finally the importance of obtaining more experimental data in this area has been stressed.

9030 **(CEGB-TPRD/B—0730/N85) Unlubricated reciprocating sliding wear of 316 stainless steel in $C0_2$ in the temperature range 20 to 600°C.** Smith, A.F. (Central Electricity Generating Board, Berkeley (UK). Berkeley Nuclear Labs.). Nov 1985. 20p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88750768/JAW.

The friction and wear behaviour of 316 stainless steel in $C0_2$ has been investigated in the load range 8 - 5ON from 20 to 600°C. Wear transitions occurred at all temperatures but were load dependent. At and below 300°C wear transitions only took place at low leads whereas above 300°C transitions were seen al all loads. The low temperature wear transition, giving an order of magnitude decrease in wear rate was associated with a change in friction behaviour. The friction force across the specimen was initially widely fluctuating and varied from cycle to cycle. After a time, which did not necessarily coincide with the wear transition the cyclic variation in the friction force become much less. This smoother sliding is thought to indicate a trend to oxide -oxide contacts. At higher temperatures wear transitions result in a two orders of magnitude reduction in wear. The corresponding friction transition was similar to the low temperature friction change but also included a marked temporary drop in the coefficient of friction.

9031 **(CEGB-TPRD/B—0743/R86) Primary creep of Zircaloy-4 in the temperature range 923-1073K.** Ecob, R.C.; Donaldson, A.T. (Central Electricity Generating Board, Berkeley (UK). Berkeley Nuclear Labs.). Jan 1986. 54p. (PWR/FBWG/P—86-330). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88750716/JAW.

The results of uniaxial constant stress creep tests on Zircaloy-4 PWR fuel cladding material are described, together with observations of the creep-induced microstructures. The shapes of the creep curves recorded at stresses below, close to and above the yield stress at temperature are categorised, and discussed in terms of the operative deformation mechanisms. At stresses below the yield stress at temperature, creep is suggested to be dominated by a diffusional mechanism. The shape of the creep curves, however, indicates that the occurrence of some dislocation activity in some grains makes a significant contribution to deformation. The interaction of, the dislocation and diffusional mechanisms needs to to understood if the details of shape of the creep curves are to be predictable.

9032 **(CONF-871126—6) Photoemission study of 5f localization in UPd/sub 3-x/(Pt,Rh)/sub x/.** Arko, A.J.; Koelling, D.D.; Dunlap, B.D.; Mitchell, A.W. (Los Alamos National Lab., NM (USA); Argonne National Lab., IL (USA)). Oct 1987. Contract W-31109-ENG-38. 15p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88002847/JAW.

From 32. conference on magnetism and magnetic materials; Chicago, IL, USA (9 Nov 1987).

Photoemission measurements in the two systems UPd/sub 3-x/(Pt,Rh)/sub x/ show that the 5f spectra are consistent with localized 5f electrons (peak in spectral weight is below E/sub F/ for all x within the double hexagonal DO_{24} phase) while at both phase transitions the 5f peaks lock in at E/sub F/ consistent with intinerancy. A satellite 5f peak representative of d-screening is observed in both localized and itinerant systems. 17 refs., 3 figs.

9033 **(CONF-871126—8) Epitaxial growth and new phase of single crystal Dy by molecular beam epitaxy.** Yang, Kai-Yueh; Homma, Hitoshi; Schuller, I.K. (Argonne National Lab., IL (USA)). Sep 1987. Contract W-31109-ENG-38. 10p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88002850/JAW.

From 32. conference on magnetism and magnetic materials; Chicago, IL, USA (9 Nov 1987).

We have grown two novel epitaxial phases of dysprosium (Dy) on vanadium (V) by molecular beam epitaxy technique. Surface and bulk structures are studied by in-situ reflection high energy electron diffraction (RHEED) and x-ray diffraction techniques. The new hcp phases are ~4% expanded uniformly in-plane (0001), and ~9% and ~4% expanded out of plane along the c-axes for non-interrupted and interrupted deposition case, respectively. We also observed (2 x 2), (3 x 3), and (4 x 4) Dy surface reconstruction patterns and a series of transitions as the Dy film thickness increases. 12 refs., 3 figs.

9034 **(CONF-871232—1) Long-term-aging embrittlement of cast duplex stainless steels: Mechanism and kinetics.** Chung, H.M.; Chopra, O.K. (Argonne National Lab., IL (USA)). Jul 1987. Contract W-31109-ENG-38. 32p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88002929/JAW.

From Symposium on properties of stainless steels in elevated temperature service; Boston, MA, USA (13 Dec 1987).

Microstructural characteristics of long-term-aged cast duplex stainless steel specimens including one from a BWR, have been investigated by SEM, TEM, SANS, and APFIM techniques. Three precipitate phases, Cr-rich α' and the Ni- and Si-rich G phase, and γ_2 austenite, have been identified in the ferrite matrix of the aged specimens. For CF-8 grade materials, $M_{23}C_6$ carbides were identified on the austenite-ferrite boundaries as well as in the ferrite matrix for aging at ≧450°C. The Si, C, and Mo contents influenced the kinetics of the G-phase precipitation. However, TEM, and APFIM analyses indicate that the embrittlement during aging at ≦400°C is primarily associated with Fe and Cr segregation in ferrite by spinodal decomposition. For extended aging, e.g., 6-8 y at 350-400°C, large platelike α' formed by nucleation and growth from the structure produced by the spinodal decomposition. The Cr content appears to either promote the platelike α' (high Cr content) or to suppress the α' in favor of γ_2 precipitation (low Cr). 21 refs., 10 figs., 2 tabs.

9035 **(CONF-871232—2) Effect of low-temperature aging on the mechanical properties of cast stainless steels.** Chopra, O.K.; Chung, H.M. (Argonne National Lab., IL (USA)). Jul 1987. Contract W-31109-ENG-38. 47p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88002872/JAW.

From Symposium on properties of stainless steels in elevated temperature service; Boston, MA, USA (13 Dec 1987).

The significance of in-service embrittlement of cast duplex stainless steels under light-water operating conditions was investigated. Mechanical property data are presented from Charpy-impact, tensile, and J-R curve tests for several heats of cast stainless steel aged up to 10,000 h at 450, 400, 350, 320, and 290°C. Thermal aging increased the tensile strength and decreased the impact energy, J/sub IC/, and tearing modulus of the steels. Also, the ductile-to-brittle transition curve shifted to higher temperatures. Fracture toughness results were consistent with the Charpy-impact data. The ferrite content and concentration of C in the steel had a strong effect on the overall process of low-temperature embrittlement. The low-carbon CF-3 steels were the most resistant and Mo-containing CF-8M steels were most susceptible to embrittlement. Weakening of the ferrite/austenite phase boundaries by carbide precipitates had a significant effect on the kinetics and extent of embrittlement of the high-carbon CF-8 and CF-8M steels, particularly after aging at temperatures ≧400°C. The influence of N content and distribution

of ferrite on loss of toughness are discussed. Data also indicate that existing correlations do not accurately represent the embrittlement behavior over the temperature range 280 to 450°C. 16 refs., 22 figs., 2 tabs.

9036 **(CONF-880137—1) Microstructural modification during laser welding.** David, S.A.; Vitek, J.M. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 18p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88002344/JAW.

From Indo/US advanced study workshop; Hyderabad, India (15 Jan 1988).

An investigation was carried out to determine the effect of rapid solidification on the weld metal microstructure of austenitic stainless steels and its implication on the ferrite constitution diagram. A wide variety of stainless steels were laser welded at different welding speeds and laser power levels. The results indicate that both weld pool cooling rate and the post solidification solid state cooling rates have a profound effect on the microstructures. For the steels investigated the microstructures ranged from duplex austenite (γ) + ferrite (δ) to fully austenitic or fully ferritic. These microstructures were found to be sensitive to both cooling rates and composition. The observed results are rationalized based on rapid solidification theory. Cooling rate effects were incorporated into the ferrite constitution diagram to reflect the observed microstructural changes at high cooling rates of the weld metal. 10 refs., 8 figs., 2 tabs.

9037 **(CONF-8706134—2) SPECOMP calculations of radiation damage in compounds.** Greenwood, L.R. (Argonne National Lab., IL (USA)). 1987. Contract W-31109-ENG-38. 11p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88003062/JAW.

From 6. ASTM/EURATOM symposium; Jackson Hole, WY, USA (1 Jun 1987).

A new computer code SPECOMP has been developed to calculate displacement damage for compound materials. The code uses primary recoil atom energy distributions from the SPECTER code and thus requires no access to nuclear data bases. For each combination of recoil and matrix atom, the code determines the secondary displacement functions and integrates over the recoil energy distributions. The net displacements for a compound is then the weighted sum of all combinations of atoms in the compound. Calculations have been completed for fusion breeders, insulators, and alloys (Li_2O, $LiAlO_2$, Al_2O_3, SiO_2, V-15Cr-5Ti, 316 ss, Nb-Ti, TaO). In cases where there are large mass differences between the atoms in the compound, the damage calculated by SPECOMP is significantly different than the weighted sum of elemental damage from SPECTER. Displacement functions for various materials are being added to the SPECTER package for routine use; however, users of SPECTER can easily perform calculations for new compounds. 6 refs., 2 figs., 1 tab.

9038 **(CONF-8710213—1) Ion bombardment effects on the near-surface composition during sputter profiling.** Lam, N.Q. (Argonne National Lab., IL (USA)). Sep 1987. Contract W-31109-ENG-38. 51p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE88003087/JAW.

From European conference on applications of surface and interface analysis; Fellbach, F.R. Germany (19 Oct 1987).

The alteration of the near-surface composition that has often been observed in ion-bombarded alloys and compounds results from the interplay of several processes. In addition to displacement mixing leading to a randomization of atomic locations, and preferential loss of alloying elements by sputtering, which are dominant at relatively low temperatures, many thermally-activated processes, including radiation-enhanced diffusion, radiation-induced segregation and Gibbsian adsorption, also play important roles. The relative significance of each process in the evolution of the sputtered flux composition and of the compositional profile of the target depends on the type of alloys, temperature and ion characteristics. The number of systematic investigations of alloy sputtering that consider all of these processes and their potential interactions is rather limited. Purpose of this paper is to characterize the processes in simple physical terms and to point out under what conditions they may become important for compositional changes in near-surface regions of sputter alloys. Selected results of recent model calculations and experimental studies will be presented to indicate the effects to be expected. 63 refs., 15 figs.

9039 **(CONF-8710214—1) Submerged arc flux welding with CaF_2-CaO-SiO_2 fluxes: Possible electrochemical effects on weld metal.** Shah, S.; Blander, M.; Indacochea, J.E. (Argonne National Lab., IL (USA); Illinois Univ., Chicago (USA). Dept. of Civil Engineering, Mechanics, and Metallurgy). 1987. Contract W-31109-ENG-38. 12p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88003107/JAW.

From International symposium on molten salts; Honolulu, HI, USA (18 Oct 1987).

Compositional changes of weld metal from welds made by submerged arc flux welding of steel using CaF_2-CaO-SiO_2 fluxes are consistent with an electrochemical mechanism in which the filler wire is anodically oxidized to form oxides and fluorides, and metals are cathodically deposited at the weld pool-flux interface. This speculative mechanism, if proven by further detailed studies, could make it possible to predict fluxes which will improve the quality of welds. 10 refs., 3 figs., 3 tabs.

9040 **(DP-MS—87-129) Weldability of general purpose heat source iridium capsules.** Kanne, W.R. Jr. (Savannah River Lab., Aiken, SC (USA)). 1988. Contract AC09-76SR00001. 5p. (CONF-880122—2). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88002442/JAW.

From 5. symposium on space nuclear power systems; Albuquerque, NM, USA (11 Jan 1988).

Two weldability tests developed by ORNL for plate material have been demonstrated on iridium (Goodwin 1987 and David 1987), but neither test is applicable to underbead cracking in a capsule configuration. As a result of underbead cracking of welded iridium capsules at SRP, a weldability test was designed and demonstrated on capsules to measure the susceptibility of different batches of iridium to underbead cracking. The capsule weldability test and its use to determine the relative weldability of the ORNL new-process iridium is presented in this paper. 6 refs., 1 fig., 1 tab.

9041 **(FEI—1751) Evaluation technique for development of investigation on corrosion in liquid metals.** Ivanov, V.A.; Solov'ev, V.A. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk. Fiziko-Ehnergeticheskij Inst.). 1985. 18p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88700842/JAW.

Accumulation of data on corrosion in liquid metals necessitates their arrangement. Formal analysis of publications will provide significant data. Investigations on corrosion in liquid metals are becoming a separate field of applied science. A survey of 10 journals gives a notion of the principal investigations in the studied field. While classifying the scientific level of the publications, they are divided into 6 sublevels, every next of which can be characterized by higher scientific and technical degree and quality of study and material presentation. The rate of growth of papers of the empirical and first theoretical levels are considered. It is predicted that by 1992-1995 the position in corrosion science will be defined by experimental and theoretical studies belonging to a higher, second theoretical level. 11 refs.; 5 figs.; 1 tab.

9042 **(IAEA-TECDOC—421) Materials reliability in the back end of the nuclear fuel cycle. Proceedings of a technical committee meeting held in Vienna, 2-5 September 1986.** (International Atomic Energy Agency, Vienna (Austria)). May 1987. 222p. (CONF-860987—). NTIS (US Sales Only), PC A10/MF A01. Order Number DE88700614/JAW.

From Technical committee on materials reliability in the back end of the nuclear fuel cycle; Vienna, Austria (2 Sep 1986).

Operating experience of nuclear fuel cycle facilities has proved that the performance and availability of key equipment largely depend on the reliability of its construction materials. In general, the materials of construction have performed well in accordance with the design criteria of equipment. In some cases, however, materials failure problems have been encountered, the causes of which are related to their corrosion and mechanical degradation. In response to the growing interest in these topics, the

IAEA convened the Technical Committee Meeting on "Materials Reliability in the Back-End of the Nuclear Fuel Cycle" at its Headquarters from September 2 to 5, 1986. This Technical Document contains the 15 papers presented during the Meeting. Material aspects of the following fields of the back-end of the nuclear fuel cycle are covered: interim and long-term storage of spent fuel; final disposal of spent fuel; storage and vitrification of High Level Liquid Wastes (HLLW); long-term storage of High Level Wastes (HLW); and spent fuel treatment. Refs, figs and tabs.

9043 (IAEA-TECDOC—421, pp 7-24) **Corrosion studies on selected packaging materials for disposal of high level wastes.** Smailos, E.; Koester, R. (Kernforschungszentrum Karlsruhe G.m.b.H., Germany, F.R. Inst. fuer Nukleare Entsorgungstechnik). May 1987. NTIS (US Sales Only), PC A10/MF A01. Order Number DE88700614/JAW. (CONF-860987—).

From Technical committee on materials reliability in the back end of the nuclear fuel cycle; Vienna, Austria (2 Sep 1986).

In order to qualify corrosion resistant materials for high level waste (HLW) packagings acting as a long-term barrier in a rock salt repository, the corrosion behaviour of the preselected materials Ti 99.8-Pd, Hastelloy C4 and two unalloyed steels was investigated. The resistance of the materials to general corrosion, local corrosion and stress corrosion cracking was examined under postulated accident conditions in the repository by long-term immersion tests of up to 4 years duration and electrochemical methods. The parameters investigated were different salt brines, temperatures of 90 deg. C, 170 deg. C and 200 deg. C as well as a gamma radiation field of 10/sup 3/Gy/h (10/sup 5/rad/h). Among the materials studied, Ti 99.8-Pd exhibited the highest corrosion resistance. This material corroded at a very low rate (<1μm/a) both with and without gamma radiation, and proved to be resistant to local corrosion and stress corrosion cracking. Hastelloy C4 exhibited a good general corrosion behaviour (≦2μm/a) but was susceptible to crevice corrosion, and pitting corrosion occured at 200 deg. C. Under gamma irradiation i.e. in the presence of strong oxidants (e.g. H/sub 2/O/sub 2/, C10/sub 3/-bar) the susceptibility of Hastelloy C4 to local corrosion increased and strong pitting and crevice corrosion was observed at 90 deg. C. The electrochemical studies confirmed the tendency of this material to local corrosion. They show that the stability of the protective passive layer is greatly reduced with increasing temperature. The two unalloyed steels (fine-grained steel and cast steel) were resistant to local and stress corrosion cracking in the absence of gamma radiation. However, the steels must be sufficiently protected against gamma radiation. An unalloyed steel seems to be the most promising material for a long-term HLW-packaging. 10 refs, 10 figs, 1 tab.

9044 (IAEA-TECDOC—421, pp 37-49) **Selection of canister materials: electrochemical corrosion tests of HASTELLOY C4 and other Ni-Cr(-Mo) alloys in chloride containing solutions.** Wolf, I.; Bort, H. (Kernforschungszentrum Karlsruhe G.m.b.H., Germany, F.R.; Siecor, Neustadt-Coburg, Germany, F.R.). May 1987. NTIS (US Sales Only), PC A10/MF A01. Order Number DE88700614/JAW. (CONF-860987—).

From Technical committee on materials reliability in the back end of the nuclear fuel cycle; Vienna, Austria (2 Sep 1986).

Several Ni-Cr(-Mo) alloys (HASTELLOY C4, INCONEL 625, SANICRO 28, INCOLOY 825, INCONEL 690) were tested by electrochemical methods to characterize their corrosion behaviour in chloride containing solutions at various temperatures and pH-values in respect to their application as canister materials for final radioactive waste storage. Especially, HASTELLOY C4 which proved to have the highest corrosion resistance of all tested alloys was tested by the following electrochemical methods: (1) Potentiodynamic measurements to determine the characteristic potentials, passive current densities and critical pitting potentials. (2) Potentiostatic measurements in order to evaluate the duration of the incubation period at various potentials. (3) Galvanostatic measurements in order to characterize critical pitting potentials. As electrolyte 1 m H/sub 2/SO/sub 4/ was used, as parameters temperature, chloride content and pH-value were varied. Variation of temperature gives the following results: an increase in temperature leads to an increase of the critical passivation current density, the passive potential bandwidth decreases slightly and the passive current density increases with rising temperature. The addition of different chloride contents to the H/sub 2/SO/sub 4/ solution shows the following effects: the critical passivation current density and the passive current density increase with increasing chloride concentration and both, the critical pitting potentials and the pitting nucleation potentials, shift towards negative values. As third parameter the pH-value was varied. As expected, an increase of the pH-value extends the passive region to more negative values, the passive current density decreases. The variation of the pH-value does not affect the critical pitting potential. All tested alloys showed a clearly limited resistance against pitting corrosion phenomena. 5 refs, 8 figs, 1 tab. (Abstract Truncated)

9045 (IAEA-TECDOC—421, pp 51-62) **Material corrosion under spent nuclear fuel storage conditions.** Kritsky, V.G.; Morozov, V.V.; Nechaev, A.F.; Khitrov, Yu.A.; Petrik, N.G.; Kalyazin, N.N.; Makarchuk, T.F. (All Union Project and Research Inst. of Complex Power Technology, Leningrad, USSR). May 1987. NTIS (US Sales Only), PC A10/MF A01. Order Number DE88700614/JAW. (CONF-860987—).

From Technical committee on materials reliability in the back end of the nuclear fuel cycle; Vienna, Austria (2 Sep 1986).

The decision is taken in the USSR to build additional independent spent fuel storage facilities for 10 or more years of NPP operation. The longer the time of SFA storage, the more severe are the requirements for fuel element cladding integrity and for all fuel assembly and storage components safety. Investigations of zirconium alloy and some steel corrosion under storage pool conditions indicated the possibility of long-term safe storage in water pools. However, model experiments indicated the probability of significant steel corrosion acceleration due to radiation exposure. 8 refs, 2 figs, 5 tabs.

9046 (IAEA-TECDOC—421, pp 63-82) **Material selection for final storage of spent fuel in a salt repository - the Pollux Cask System as an example.** Einfeld, K.; Popp, F.W.; Knapp, U. (Deutsche Gesellschaft fuer Wiederaufarbeitung von Kernbrennstoffen m.b.H., DWK, Hannover, Germany, F.R.; Kernforschungszentrum Karlsruhe G.m.b.H., Germany, F.R.). May 1987. NTIS (US Sales Only), PC A10/MF A01. Order Number DE88700614/JAW. (CONF-860987—).

From Technical committee on materials reliability in the back end of the nuclear fuel cycle; Vienna, Austria (2 Sep 1986).

In the framework of the development of containers for the final disposal of radioactive waste in salt deposits DWK conceived the Pollux Cask System. This cask system is highly flexible in so far as it is capable of bearing extremely different types of waste such as integral fuel elements, consolidated rods, HTR-pebble elements, consolidated structure materials, solidified high active waste etc. The Pollux cask system is characterized by an anticorrosive coating of Hastelloy C4 which is applied to by surface welding. With regard to its long term behaviour comprehensive corrosion tests on Hastelloy C4 were performed in Q-brain. This report presents a survey on results of these corrosion tests; especially recent results of long term integral tests (lasting about two years) on two cask models will be reported about. Moreover investigations on surface corrosion and local corrosion in dependence of the temperature will be reported about in order to demonstrate the limits of application of the anti-corrosive coating. 16 figs.

9047 (IAEA-TECDOC—421, pp 83-96) **HLLW storage tank materials: technical options and operating experience.** Bachelay, J.; Decours, J.; Demay, R.; Pelras, M.; Turluer, G.; Rozand, L. (Societe Generale pour les Techniques Nouvelles S.G.N., 78 - Saint-Quentin-en-Yvelines, France; CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette, France. Inst. de Recherche Technologique et de Developpement Industriel, IRDI; CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92, France. Inst. de Recherche Technologique et de Developpement Industriel, IRDI; Cogema, Saint-Quentin-en-Yvelines, France). May 1987. NTIS (US Sales Only), PC A10/MF A01. Order Number DE88700614/JAW. (CONF-860987—).

From Technical committee on materials reliability in the back end of the nuclear fuel cycle; Vienna, Austria (2 Sep 1986).

Storage tanks for concentrated fission product solutions are made of Z 2 CND 17-12 (AISI 316 L) stainless steel. The solution temperature is cooled below 60 deg. C and permanent stirring of the medium keeps the insolubles in suspension preventing the formation of wall deposits. This stainless steel was selected after a number of corrosion tests conducted "in situ" in the tanks of nuclear facilities and in radioactive fisaion product solutions prepared in the laboratory. All these tests demonstrated a superior localized corrosion resistance under radioactive deposits for AISI 316 L steel, when compared to AISI 304 L steel. Laboratory tests were also performed up to 100 deg. C in fission product solutions containing ferric ions (up to 20 g.l/sup -1/). Under these conditions, more severe than nominal operating conditions, 316 L steel exhibits some risks of intergranular attack. The operating conditions adopted, and the experience gained in France over the past 30 years, clearly vindicate the choice of 316 L steel. 8 figs, 6 tabs.

9048 (IAEA-TECDOC—421, pp 107-116) **Selection of suitable stainless steels for nuclear reprocessing plants: application of chemical and electrochemical testing methods to austenitic CrNi steel AISI type 304L in various chemical compositions.** Leistikow, S.; Kraft, R.; Simon, R.; Schneider, M. (Kernforschungszentrum Karlsruhe GmbH, Germany, F.R. Institut fuer Material- und Festkoerperforschung 2; Technische Univ. Muenchen, Germany, F.R. Lehrstuhl fuer Metallurgie und Metallkunde; Siemens A.G., Erlangen, Germany, F.R.). May 1987. NTIS (US Sales Only), PC A10/MF A01. Order Number DE88700614/JAW. (CONF-860987—).

From Technical committee on materials reliability in the back end of the nuclear fuel cycle; Vienna, Austria (2 Sep 1986).

DIN Standard Huey testing has been performed in boiling 14.4n nitric acid during 5-15 periods (240-720 h) for selection of appropriate nitric acid resistant materials for nuclear fuel reprocessing applications. The paper describes the testing process during which the intermediate and final results of metal loss by dissolution are directly transferred from the balance to the computer, stored and activated - besides material properties data - for documentation purposes. Further routine evaluation of these experiments includes metallography in cross-section and surface microscopy to look after uniform and local metal dissolution phenomena and their relationship to the bulk structure. A large variety of materials have been tested this way through the last years. It was shown how sensitively the chosen testing conditions are able to differ between materials of the same nominal composition AISI 304L/Material No. 1.4306 in different contents of residual elements. Especially, for the purest electroslag-molten steel (ESU) results of parameter studies concerning the influence of sensitization, cold deformation, grain size and sheet thickness (in respect to end grain attack) are given. Within an attempt to define faster methods of corrosion testing, e.g. to differ within a group of materials of similar composition, but different corrosion behaviour, electrochemical tests in heated nitric acid were performed under potentiostatic conditions. The necessary electrochemical equipment and the results of its application by potentiostatic tests on AISI 304L in above mentioned three chemical compositions at 1250 mV, 14n HNO/sub 3/ are presented. 5 refs, 5 figs, 2 tabs. (Abstract Truncated)

9049 (IAEA-TECDOC—421, pp 117-127) **Austenitic stainless steels: assessment of progress in materials performance for reprocessing applications.** Decours, J.; Decugis, J.C.; Demay, R.; Pelras, M.; Turluer, G. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette, France. Inst. de Recherche Technologique et de Developpement Industriel, IRDI; Societe Generale pour les Techniques Nouvelles S.G.N., 78 - Saint-Quentin-en-Yvelines, France; CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92, France. Inst. de Recherche Technologique et de Developpement Industriel, IRDI). May 1987. NTIS (US Sales Only), PC A10/MF A01. Order Number DE88700614/JAW. (CONF-860987—).

From Technical committee on materials reliability in the back end of the nuclear fuel cycle; Vienna, Austria (2 Sep 1986).

Spent fuel reprocessing involves various operations in which nitric acid is used at relatively high concentrations and at temperatures up to the boiling point. The choice of Z 2 CN 18-10 stainless steel (AISI 304 L) is a satisfactory solution to mitigate corrosion problems when using solutions with a maximum concentration of 8N, up to the boiling point. Above this concentration, since the corrosion rate is significantly higher, it is better to use Z 2 CN 25-20 stainless steel (Creusot-Loire's URANUS 65). Despite these advantages, these stainless steels are not immune to intergranular corrosion, if the medium containing oxidizing species or ions (such as Cr VI, Pu VI or higher concentrations of FE III) places the material in transpassive conditions. In this case it is recommended to use silicon-rich stainless steel (4% Si) Z 1 CNS 17-15 (Creusot-Loire's URANUS S1N). Whatever the steel grade used, however, when cross-sections of plates, pipes, or forgings are exposed to the corrosive medium, the development in the rolling direction of end-grain attack (tunnel corrosion) can hardly be prevented. End-grain attack most usually spreads from non-metallic line inclusions caused by working, forging and rolling operations (sulphides being the most dangerous inclusions). This form of corrosion may also occur in oxidizing media, along zones segregated in chromium, molybdenum or silicon, and/or along second-phase alignments such as ferrite or σ phase. A very-low carbon material with good inclusion cleanliness can be obtained by a specially designed argon vacuum process. The proper control of the preparation and transformation processes yields, for this material, semi-finished products perfectly suitable for use in nitric acid media with respect to hazards in developing end-grain attack, regardless of the presence or absence of oxidizing species or ions. 10 figs, 1 tab.

9050 (IAEA-TECDOC—421, pp 147-153) **Study of the chemical structure of films formed during transpassive to passive transitions on a cathodically protected AISI 430 ferritic stainless steel.** Ben Haim, M.; Atzmony, U.; Shamir, N.; Yahalom, J. (Israel Atomic Energy Commission, Beersheba. Nuclear Research Center-Negev; Technion-Israel Inst. of Tech., Haifa). May 1987. NTIS (US Sales Only), PC A10/MF A01. Order Number DE88700614/JAW. (CONF-860987—).

From Technical committee on materials reliability in the back end of the nuclear fuel cycle; Vienna, Austria (2 Sep 1986).

AISI 430 stainless steel can be cathodically protected in highly oxidizing solutions. The freely corroding potential of this stainless steel in such solutions is transpassive. In the protecting process this potential is lowered from the transpassive to the passive zone by applying potentiostatic techniques. The chemical structures of the surface films formed during the various stages of this potential shift were investigated by X-ray and Auger electron spectroscopies combined with Ar/sup +/ ion sputtering for depth profiling and by scanning electron microscopy. The shift is accompanied by two distinct phenomena: a) Increase of the concentration ratio of the oxidized to the metallic states of the iron and of the chromium present in the film. This implies that films formed in the passive zone are thicker than those formed in the transpassive one, a fact which is also revealed by the Auger depth profiles. b) Formation of a layered structure in the passive zone which is characterized by chromium surface segregation in the film. Three layers were detected. The layer at the metal film interface is composed of Cr/sup +3/ oxide whereas the two layers above it are composed of mixed iron and chromium oxides with the iron being primarily of Fe/sup +2/ type in the intermediate layer and of Fe/sup +3/ type in the outer one. 7 refs, 6 figs.

9051 (IAEA-TECDOC—421, pp 155-163) **Long-term storage problems of spent LWR fuel elements.** Cech, B.; Kaderabek, E.; Koutsky, J. (Ustav Jaderneho Vyzkumu CSKAE, Rez, Czechoslovakia). May 1987. NTIS (US Sales Only), PC A10/MF A01. Order Number DE88700614/JAW. (CONF-860987—).

From Technical committee on materials reliability in the back end of the nuclear fuel cycle; Vienna, Austria (2 Sep 1986).

The concept of spent fuel storage in Czechoslovakia is based on storage for 5 years followed by transport to the reprocessing plant. General considerations on fuel assembly integrity during its prolonged pool storage and transport of spent fuel container were given taking into account the possible effects of fuel burnup increase and load following mode of reactor operation. 6 refs, 4 tabs.

9052 (IAEA-TECDOC—421, pp 193-206) **Materials reliability in the back-end of the fuel cycle: Argentine experience.** Geldstein, M.C. (Comision Nacional de Energia Atomica, Buenos Aires, Argentina). May 1987. NTIS (US Sales Only), PC A10/MF A01. Order Number DE88700614/JAW. (CONF-860987—).

From Technical committee on materials reliability in the back end of the nuclear fuel cycle; Vienna, Austria (2 Sep 1986).

Reliability of materials at the back-end of the fuel-cycle is a subject of permanent interest for countries that have nuclear reactors. Safety, at that stage, should be understood as the system of physical barriers to prevent radioactivity release into the environment. Those barriers must be reliable during extended periods, e.g. 50 to 100 years for interim spent fuel storage, and over 1,000 years for permanent waste disposal. The first physical barrier is the fuel itself, namely pellets and cladding. Independently of the selected intermediate storage (dry or wet storage) fuel integrity, decay heat extraction and appropriate shielding, must be guaranteed. Two PHWR nuclear reactors are now operating (ATUCHA-I: 345 MWe; EMBALSE: 600 MWe) and one more is being built (ATUCHA-II: 745 MWe), 700 additional MWe of nuclear origin, are planned to be connected to the electrical power distribution nets during the next 15 years. For intermediate spent fuel storage, wet technology has been selected. At present, 8200 CANDU type spent fuels are in the EMBALSE pools and 4300 ATUCHA-I type ones are in the ATUCHA-I pools. A thorough control and maintenance program on materials that can stay under water during long periods, is being investigated. Materials used for high level waste containment, as lead, are being characterized. Herewith is described the management of fuel pools, chemical and radiochemical controls, studies for the proper selection of structural materials and for a high level waste disposal container. 9 refs, 3 figs, 7 tabs.

9053 (INIS-BR—878) **Influence of non-metallic elements in the mechanical properties of 20 Mn Mo Ni 55 steel.** Cardoso, J.C.B.R. (NUCLEP, Rio de Janeiro (Brazil)). [Sep 1987]. 60p. (In Portuguese). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88700412/JAW.

Usual methods for determining non-metallic elements in steels are studied. Those methods are: a) Standard methods of ASTM and ISO and b) Modern and fast methods of detection, non-standard. The steel used was 20 Mn Mo Ni 55. (E.G.).

9054 (INIS-BR—903, pp 453-456) **Fabrication of amorphous ribbons using a 'melt-spinner'.** Oliveira, R.F.; Missell, F.P. (Sao Paulo Univ., Brazil. Inst. de Fisica). 1984. (In Portuguese). NTIS (US Sales Only), PC A12/MF A01. Order Number DE88700663/JAW. (CONF-8402101—).

From Simposio Latino-Am. de Fis. dos sistemas amorfos; Niteroi, Brazil (1 Feb 1984).

In this letter, it is reported the construction of a 'melt-spinner' used in the fabrication of amorphous ribbons. For the alloy Fe/sub 80/ B/sub 20/, it is studied the width of the ribbon as a function of the flux of incident material. The results agree with the theoretical model which considers the energy equilibrium on the cooling surface as a dominant factor in the formation of the ribbon.

9055 (INIS-BR—903, pp 457-460) **Structure of amorphous Fe/sub 25/ Zr/sub 75/ by Moessbauer spectroscopy.** Rotenberg, L.R.K.; Rechenberg, H.R. (Sao Paulo Univ., Brazil. Inst. de Fisica). 1984. NTIS (US Sales Only), PC A12/MF A01. Order Number DE88700663/JAW. (CONF-8402101—).

From Simposio Latino-Am. de Fis. dos sistemas amorfos; Niteroi, Brazil (1 Feb 1984).

The Moessbauer spectra of paramagnetic Fe-Zr alloys in several concentrations were studied and it is shown that a certain specific distribution can describe the Fe/sub 25/ Zr/sub 75/ spectrum as well as others authors distributions. (M.W.O.).

9056 (INIS-BR—903, pp 478-482) **Measurement with DSC on the alloy FE/sub 81/ B/sub 13/,/sub 5/ Si/sub 3/,/sub 5/ C/sub 2/.** May, W.; Grandi, T.A.; Sebastianes, R.M. (Santa Catarina Univ., Florianopolis, Brazil. Dept. de Fisica). 1984. (In Portuguese). NTIS (US Sales Only), PC A12/MF A01. Order Number DE88700663/JAW. (CONF-8402101—).

From Simposio Latino-Am. de Fis. dos sistemas amorfos; Niteroi, Brazil (1 Feb 1984).

The latent heat and the activation energy measurements in the amorphous-crystal phase transition of the Fe/sub 81/ B/sub 13/,/sub 5/ Si/sub 3/,/sub 5/ C/sub 2/ alloy is presented. (M.W.O.).

9057 (INIS-BR—903, pp 401-406) **Macroscopic and microscopic magnetism of metal-metalloid amorphous alloys.** Vasconcellos, M.A.Z.; Fichtner, P.F.P.; Livi, F.P.; Costa, M.I. da; Baibich, M.N. (Rio Grande do Sul Univ., Porto Alegre, Brazil. Inst. de Fisica). 1984. (In Portuguese). NTIS (US Sales Only), PC A12/MF A01. Order Number DE88700663/JAW. (CONF-8402101—).

From Simposio Latino-Am. de Fis. dos sistemas amorfos; Niteroi, Brazil (1 Feb 1984).

In this paper is investigated the interrelation between macroscopic and microscopic magnetic phenomena using experimental data from Moessbauer effect and the magnetization of layers of amorphous (Fe/sub 1-x/ Ni/sub x/) /sub 80/ B/sub 20/. The Moessbauer effect measurement show a distribution of hyperfine fields in Fe site as well as a likely distribution of isomeric shifts (M.W.O.).

9058 (INIS-BR—903, pp 434-437) **Moessbauer and X Ray diffraction studies in (In/sub 16/ Te/sub 84/)/sub 1-x/ Sn/sub x/ and (Ge/sub 85/ Te /sub 15/)/sub 1-x/ Sn/sub x/ amorphous alloys.** Arcondo, B.; Quintana, G.; Sirkin, H. (Buenos Aires Univ., Argentina. Faculdad de Ingenieria). 1984. NTIS (US Sales Only), PC A12/MF A01. Order Number DE88700663/JAW. (CONF-8402101—).

From Simposio Latino-Am. de Fis. dos sistemas amorfos; Niteroi, Brazil (1 Feb 1984).

Solid samples of (In/sub 16/ Te/sub 84/)/sub 1-x/ Sn/sub x/ and (Ge/sub 15/ Te/sub 85/)/sub 1-x/ Sn/sub x/ were obtained by means of splat-cooling techniques. The materials was cooled down from different initial temperatures of the liquid state and the samples were analysed by Moessbauer Spectroscopy and X Ray diffraction. (M.W.O.).

9059 (INIS-mf—11054, pp 45) **Diffusion investigations in Nb/sub 3/Sn tin kernel superconductors .** Eibler, R.; Kirchmayr, H.; Kny, E. (Technische Univ., Vienna, Austria. Inst. fuer Experimentalphysik; Metallwerke Plansee Ges.m.b.H., Reutte, Austria). Sep 1987. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88700772/JAW. (CONF-8709196—).

From Annual convention fo the Austrian Physical Society; Vienna, Austria (21 Sep 1987).

9060 (INIS-mf—11054, pp 52) **Electronic properties of rare-earth iron compounds (REFe/sub 2/).** Gratz, E.; Bauer, E.; Poellinger, S.; Piringer, A.; Nowotny, H. (Technische Univ., Vienna, Austria. Inst. fuer Experimentalphysik; Technische Univ., Vienna, Austria. 1. Inst. fuer Theoretische Physik). Sep 1987. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88700772/JAW. (CONF-8709196—).

From Annual convention fo the Austrian Physical Society; Vienna, Austria (21 Sep 1987).

9061 (JAERI-M—87-114) **Fatigue and uniaxial deformation behavior of Hastelloy XR at elevated temperatures.** Kanazawa, Kenji; Yamaguchi, Koji; Nishijima, Satoshi; Nishiguchi, Isoharu; Muto, Yasushi; Tsuji, Hirokazu. (Japan Atomic Energy Research Inst., Tokyo). Aug 1987. 46p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88751058/JAW.

Fully reversed continuous cycling tests and tensile tests were conducted on Hastelloy XR at temperatures ranging from 600 deg C to 950 deg C in air. Fatigue life of Hastelloy XR depends on temperature. A series of SEM observation revealed that transgranular fracture with evident striation formation was dominant at temperatures below 800 deg C, while intergranular cracking was found above 900 deg C. These results suggest that creep mechanism takes place in the fatigue behavior of this alloy above 900 deg C. Numer-

ical analyses of deformation behavior during fatigue and tensile tests were conducted to interpret the experimental results. Conventional elastic-creep constitutive equation gave a good prediction of this deformation process.

9062 **(JET-R—85-04) Welding and brazing of the JET machine components.** Walravens, M.J. (ed.). (Commission of the European Communities, Abingdon (UK). JET Joint Undertaking). Oct 1985. 108p. NTIS (US Sales Only), PC A06/MF A01. Order Number DE88750709/JAW.

The report covers the techniques used for joining the various parts of the machine. The difficulties encountered during the welding and brazing of similar and dissimilar metals are underlined and the solutions adopted to solve them are indicated. The vast experience gained by those involved in the processes of joining the various parts of the JET machine components, and the lessons learnt are summarized in this report.

9063 **(LA—11063-MS-Vol.1) Theory of deformation: Part 1, Kinematics.** Dienes, J.K. (Los Alamos National Lab., NM (USA)). Dec 1987. Contract W-7405-ENG-36. 51p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE88003007/JAW.

The purpose of this report is to develop the kinematic basis for a theory of deformation of materials with defects. One specific objective is to derive clear concepts of strain, strain-rate, stress and stress rate, and to demonstrate some new relations between measures of these quantities. A related objective is to clarify the concepts of strain, strain rate and stretching, so that the principle of superposition of strain rates can be developed in a systematic way in subsequent reports. This principle allows us to compute deformations involving both plastic flow and fragmentation. The theory of large deformation is addressed in a systematic manner with the polar decomposition theorem as a starting point. Two sets of orthogonal axes are distinguished, space axes that are fixed in ambient space, and polar axes that are related to material deformation. It is shown that in elasticity, Piola stress is a measure in polar axes. In addition, a special approach to computing rates of tensor quantities, called polar rates, is derived from several viewpoints. This allows us to compute rates in a manner that accounts for material rotation in an exact way. One consequence of this is a simple relation between Signorini strain rate and stretching, the symmetric part of the velocity gradient. A second result is to show that the polar stress rate is the appropriate measure of rate of change of Cauchy stress, and that the more traditional stress rate of Zaremba, Jaumann, and Noll is only an approximation, valid at small strains. Examples are described for materials undergoing simple shear, vortex motion and torsion. 20 refs., 10 figs.

9064 **(LA-UR—87-3617) Chemical short-range order in dense random packed models.** Saw, C.K.; Schwarz, R.B. (Los Alamos National Lab., NM (USA); Hoechst Celanese Corp., Summit, NJ (USA)). 1987. Contract W-7405-ENG-36. 19p. (CONF-8708104—4). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88001800/JAW.

From Conference on solid state amorphizing transformation; Los Alamos, NM, USA (10 Aug 1987).

A dense random packed model of an amorphous alloy was used to calculate the total and partial reduced radial distribution functions, the Bhathia-Thorton number-concentration fluctuations, and the number-concentration interference functions. The model was applied to amorphous $Ni_{35}Ti_{65}$ using atomic radii of 1.10 and 1.58 A^{-1} for nickel and zirconium, respectively. Chemical short-range order was included in the model by permuting nickel-zirconium nearest-neighbors atoms pairs in response to a decrease in the alloy's enthalpy. The permutations were found to decrease in the Warren-Cowley order parameter from zero to -0.38. The increase in chemical short range order is accompanied by the appearance of a peak in the partial interference function I/sub Ni-Ni/(K) at K = 1.9 A^{-1}. The increase in chemical short range order and the prepeak in I/sub Ni-Ni/(K) are tentatively attributed to the formation of double tetrahedra with three zirconium atoms at the base and two nickel atoms at the apexes. 18 refs., 5 figs.

9065 (LBL—22075, pp 45-63) **Structural materials.** Apr 1987. NTIS, PC A06/MF A01. Order Number DE88000686/JAW.

In Center for Advanced Materials: Annual report, 1986.

The current research in areas in the development and performance of four engineering materials that were selected after consultation with the Department of Energy and concerned industries are: Light alloys for advanced aerospace systems, sheet metal forming for advanced manufacturing, fatigue-resistant solder joints for electrical contacts, and advanced superconductors and cryogenic structural materials for magnetic fusion energy devices. Each of these research programs is conducted in collaboration with industrial or national laboratory groups that are potential users of the research and receives supplementary funding from industry or from offices of DOE in addition to the Division of Materials Sciences. 49 refs., 15 figs.

9066 **(N—87-29662) High temperature radiator materials for applications in the low earth orbital environment.** Rutledge, S.K.; Banks, B.A.; Mirtich, M.J.; Lebed, R.; Brady, J.; Hotes, D.; Kussmaul, M. (National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center). 1987. 19p. (NASA-TM—100190; E—3772; NAS—1.15:100190; CONF-870438—). NTIS, PC A02/MF A01.

From Spring meeting of the Materials Research Society; Anaheim, CA, USA (21 Apr 1987).

Radiators must be constructed of materials which have high emittance in order to efficiently radiate heat from high temperature space power systems. In addition, if these radiators are to be used for applications in the low Earth orbital environment, they must not be detrimentally affected by exposure to atomic oxygen. Four materials selected as candidate radiator materials (304 stainless steel, copper, titanium-6% aluminum-4% vanadium (Ti-6%Al-4%V), and niobium-1% zirconium (Nb-1%Zr)) were surface modified by acid etching, heat treating, abrading, sputter texturing, electrochemical etching, and combinations of the above in order to improve their emittance. Combination treatment techniques with heat treating as the second treatment provided about a factor of two improvement in emittance for 304 stainless steel, Ti-6%Al-4%V, and Nb-1%Zr. A factor of three improvement in emittance occurred for discharge chamber sputter textured copper. Exposure to atomic oxygen in an RF plasma asher did not significantly change the emittance of those samples that had been heat treated as part of their texturing process. An evaluation of oxygen penetration is needed to understand how oxidation affects the mechanical properties of these materials when heat treated.

9067 **(SAND—87-1201C) The oxidation of Ba dosed Mo(100) surfaces with O_2 at moderately high temperatures.** Rogers, J.W. Jr.; Blair, D.S.; Paffett, M.T. (Sandia National Labs., Albuquerque, NM (USA); Los Alamos National Lab., NM (USA)). 1987. Contract AC04-76DP00789. 11p. (CONF-871027—40). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88002511/JAW.

From 172. meeting of the Electrochemical Society; Honolulu, HI, USA (18 Oct 1987).

The oxidation of Mo(100) and Ba-covered Mo(100) by O_2 have been examined at moderately high temperature (700 to 1400°K) using x-ray photoelectron spectroscopy. Results indicate that the Ba or BaO overlayer retards but does not prevent oxidation of the underlying Mo surface. The high temperature surface chemistry of the O/Ba/Mo surface is described. 11 refs., 3 figs.

9068 **(SAND—87-1283C) Field ion microscope studies of the deuterium-induced surface reconstruction of Ni(110).** Kellogg, G.L. (Sandia National Labs., Albuquerque, NM (USA)). 1987. Contract AC04-76DP00789. 7p. (CONF-871125—12). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88002523/JAW.

From 34. national vacuum symposium and topical conference; Anaheim, CA, USA (2 Nov 1987).

This investigation involved the (1 x 2) reconstruction of the Ni(110) surface induced by the adsorption of deuterium in the temperature range from 165-175 K. The (1 x 2) phase of Ni(110), which is produced upon adsorption of either hydrogen or deuterium at or near saturation coverage, is known to involve reconstruction of the substrate, but there has been some controversy as to whether the surface structure involves missing rows or paired rows.

Purpose of this investigation was to determine if the atomic structure of the reconstructed surface could be identified by field ion microscopy. 8 refs., 2 figs.

9069 **Production of glass or glass-ceramic to metal seals with the application of pressure.** Kelly, M.D.; Kramer, D.P. (to Dept. of Energy, Washington, DC). US Patent 4,705,585. 10 Nov 1987. Filed date 4 Jan 1985. vp. Patent and Trademark Office, Box 9, Washington, DC 20232.

This patent describes a process for preparing a glass or glass-ceramic to metal seal comprising contacting the glass with the metal and heat-treating the glass and metal under conditions whereby the glass to metal seal is effected and, optionally, the glass is converted to a glass-ceramic. The improvement comprises carrying out the heat-treating step under hot isostatic pressing and using molten glass.

9070 **Thermodynamic properties of nickel.** Desai, P.D. (Purdue Univ., West Lafayette, IN). *International Journal of Thermophysics;* 8: No. 6, 763-780(Nov 1987).

This work reviews and discusses the data and information on the thermodynamic properties of nickel available through May 1984. These properties include heat capacity, enthalpy, enthalpy of transition and melting, vapor pressure, and enthalpy of vaporization. The recommended values for heat capacity cover the temperature range from 1 to 3200 K. The recommended values for enthalpy, entropy, Gibbs energy function, and vapor pressure cover the temperature range from 298.15 to 33200 K.

9071 **Thermodynamic properties of titanium.** Desai, P.D. (Purdue Univ., West Lafayette, IN). *International Journal of Thermophysics;* 8: No. 6, 781-794(Nov 1987).

This work reviews and discusses the data and information on the thermodynamic properties of titanium available through May 1984. These properties include heat capacity, enthalpy, enthalpy of transition and melting, vapor pressure, and enthalpy of vaporization. The recommended values for heat capacity cover the temperature range from 1 to 3800 K. The recommended values for enthalpy, entropy, Gibbs energy function, and vapor pressure cover the temperature range from 298.15 to 3800 K.

9072 **Anisotropic upper critical fields of disordered Nb/sub 0.53/Ti/sub 0.47/-Ge multilayers.** Jin, B.Y.; Ketterson, J.B.; McNiff, E.J. Jr.; Foner, S.; Schuller, I.K. (Northwestern Univ., Evanston, IL). *Journal of Low Temperature Physics;* 69: No. 1-2, 39-50(Oct 1987). Contract W-31-109-ENG-38.

Studies are reported of the upper critical fields of Nb/sub 0.53/Ti/sub 0.47/-Ge multilayers consisting of thick Ge layers and varying-thickness Nb/sub 0.53/Ti/sub 0.47/ layers. Both the angular dependence and the temperature dependence of the upper critical fields indicate a dimensional crossover at a Nb/sub 0.53/Ti/sub 0.47/ layer thickness near 200 A. All the 2D samples display a cusplike upper critical field angular dependence with a sharper cusp for thinner Nb/sub 0.53/Ti/sub 0.47/ layers. The parallel upper critical fields are tentatively fitted with an expression combining the 2D field dependence of Rickayzen, the paramagnetic limiting behavior of Maki, and the disorder-related Coulomb interaction effects of Maekawa and Fukuyama. The perpendicular fields are fitted with the Maekawa, Ebisawa, and Fukuyama theory; better agreement is obtained for thinner Nb/sub 0.53/Ti/sub 0.47/ sublayers when the paramagnetic limiting effect is included.

9073 **Effect of surface-applied reactive element oxide on the oxidation of binary alloys containing Cr.** Hou, P.Y.; Stringer, J. (Lawrence Berkeley Lab. and Dept. of Materials Science and Mineral Engineering, Univ. of California, Berkeley, CA 94720). *Journal of the Electrochemical Society;* 134: No. 7, 1836-1849(Jul 1987). Contract AC03-76SF00098.

The influence of surface-applied Ca,Ce, Hf, La, Y, and Zr nitrate-converted oxides on the oxidation behavior of Co-15 weight percent (w/o) Cr, Co-25 w/o Cr, and Ni-25 w/o Cr alloys at 1000° and 1100°C in 1 atm O/sub 2/ was studied. The surface oxides were most beneficial on the established Cr/sub 2/O/sub 3/ forming alloy. Surface-applied CeO/sub 2/,Y/sub 2/O/sub 3/, and La/sub 2/O/sub 3/ were effective in reducing the growth rate of the Cr/sub 2/O/sub 3/ scale and improving the scale adhesion. The presence of these surface oxides also prevented base metal oxide formation and changed the growth direction of the scale. All of these observed effects were similar to those found when the reactive element oxides were present within the alloys. However, the presence of surface HfO/sub 2/ made the oxide scales nonadherent causing a breakaway behavior at the early stage of the oxidation process. None of the surface-applied oxides showed any effects on the non-Cr/sub 2/O/sub 3/ forming alloy, and they acted as a semibarrier on the borderline Cr/sub 2/O/sub 3/ former. Unlike the case of dispersoids present in the alloy, these surface-applied as a semibarrier on the borderline Cr/sub 2/O/sub 3/ layer at alloy Cr levels lower than those normally required to form the Cr/sub 2/O/sub 3/ scale.

9074 **Equilibrium segregation in an antimony-containing stainless steel.** Kenik, E.A. (Metals and Ceramics Div., Oak Ridge National Lab., Oak Ridge, TN 37831). *Scripta Metallurgica;* 21: No. 6, 811-816(Jun 1987). Contract AC05-84OR21400.

In this study equilibrium segregation was measured by x-ray microanalysis in an AEM and related to boundary character and structure. Equilibrium segregation of antimony in an austenitic stainless steel was investigated by x-ray microanalysis. Fractional monolayer coverages of antimony were detected at grain boundaries, as well as nickel enrichment and chromium depletion. Equilibrium segregation depends on boundary character. The measured apparent compositions are corrected for the relative spatial extents of the segregant layer and the excited volume. Segregation of antimony to boundary dislocations depends on dislocation character. Alloy composition (in atomic percent) was 68.1 Fe, 16.1 Cr, 14.2 Ni, 0.79 Si, 0.46 Sb, 0.20 Mn, and 0.12.

9075 **Durability and performance of coatings in gas turbine and diesel engines.** Fairbanks, J.W.; Hecht, R.J. (Department of Energy, Washington, DC, USA; Pratt and Whitney Aircraft, West Palm Beach, FL, USA). *Materials Science and Engineering;* 88: 321-330(Apr 1987). (CONF-860718—).

From High temperature corrosion international symposium; Marseilles, France (7 Jul 1986).

In this paper coating developments for advanced gas turbine engines (diffusion aluminide coatings, overlay coatings, and ceramic thermal barrier coatings) were desorbed, a selection of current metallic coatings was made and their performance as outlined. Finally coating developments for advanced diesel engines with a view to improved turbocharging or to low heat rejection engines (adiabatic diesel concept) were dealt with. (IHOE).

9076 **Limitations of the Chen and Argon and Martinez and Nix models for intergranular cavity growth.** Schneibel, J.H.; Martinez, L. (Metals and Ceramics Div., Oak Ridge National Lab., Oak Ridge, TN 37831). *Scripta Metallurgica;* 21: No. 4, 495-500(Apr 1987). Contract AC05-84OR21400.

In this work two inconsistencies in the analyses for diffusive-plastic cavity growth are been pointed out. The plastic hole growth limit and the agreement with the Needleman and Rice analysis in the C and A and M and N models are due to inappropriate mechanical equilibrium conditions in the solution of the diffusive growth equations. Also, physically correct equations for the enhancement of diffusive growth rates by plastic flow have been derived.

9077 **Separation and characterization of stress levels and texture in metal sheet and plate. II. Rolled copper sheet experiment.** Armstrong, P.E.; Eash, D.T.; O'Rourke, J.A.; Smith, J.F. (Los Alamos National Lab., NM). *Journal of Nondestructive Evaluation;* 6: No. 1, 33-45(Mar 1987).

In this paper, the authors compared elastic shear moduli determined by EMAT techniques to x-ray pole figure measurements for three lots of rolled copper sheet. All moduli (C'_{44}, C'_{55}, C'_{56}) decreased with rolling reduction to more than -10% for a 90% rolling reduction and the difference between C_{44} and C_{55} increased with developing in-plane anisotropy as predicted in Part 1. Pole figures of (111) and 200) planes revealed various initial textures for the

starting annealed plates, and (111) pole rotation toward a single well-defined preferred orientation at large rolling reductions. Stress relief annealing of a heavily cold rolled plate produced no significant changes in elastic moduli while hardness decreased, thus indicating that textural changes were responsible for the observed moduli changes.

9078 **Theoretical study of the dynamic tensile test.** Regazzoni, G.; Johnston, J.N.; Follansbee, P.S. New York, NY; American Society of Mechanical Engineers (1987). 10p. (CONF-861211—). American Society of Mechanical Engineers, 345 East 47 St., New York, NY 10017.

From American Society of Mechanical Engineers winter meeting; Anaheim, CA, USA (7 Dec 1986).

Technical Paper 86-WA/APM-39.

A numerical investigation of the tensile test using a finite-difference, one-dimensional elasto-viscoplastic code is presented. The influence of strain rate, strain rate sensitivity, and inertia on the development of the axial particle velocity, stress, strain, and strain rate profiles in pure copper is studied. The initial stages of post-uniform deformation and the stabilizing influence of inertia and strain rate sensitivity in this regime are demonstrated. Both inertia and strain rate sensitivity are shown to decrease the rate of unloading of the uniform region of a tensile specimen past the point of instability given by the maximum load criterion. A comparison of numerically predicted and experimentally determined values of the post-uniform elongation is shown.

9079 **Charge transfer processes and sputtering processes of self-sustaining alkali metal coatings on metal surfaces.** Krauss, A.R.; Auciello, O.; Uritani, A.; Valentine, M.; Mendelsohn, M.; Gruen, D.M. (Materials Science and Chemistry Divisions, Argonne National Lab., Argonne, IL 60439). pp 209-220 of Particle and photon interactions with surfaces. Gruen, D.M.; Krauss, A.R.; Pellin, M.J.; Young, C.E. New York, NY; Elsevier Science Pub. Co. Inc. (1987). (CONF-860807—). Contract W-31-109-ENG-38.

From 6. international workshop on inelastic ion surface collisions; Argonne, IL, USA (25 Aug 1986).

It is well known that adsorption of electronegative or electropositive atoms on a metal surface results in charge transfer between the metal conduction band and the adsorbate atom. This charge transfer results in the formation of a coverage-dependent image dipole and a consequent change in the work function and adsorbate binding energy. Additionally, the secondary electron yield and the charge state of surface atoms desorbed by thermal, electron impact or ion impact desorption processes are closely related to the effective adsorbative charge. The authors discuss here the effect of Gibbsian segregation as a means of producing similar effects for electropositive (alkali metal) layers on a number of metal substrates. Classical chemisorption theory is used as a means of estimating the adsorbate effective charge and the results are compared with models used to predict the secondary ion fraction of sputtered atoms. The resulting concept of self-sustaining sputter-resistant coastings is analyzed in the context of applications to the fusion environment as well as to, e.g., materials for high current electrical contacts.

9080 **The use of low energy alkali ion scattering as a probe of surface structure.** Overbury, S.H. (Oak Ridge National Lab., Oak Ridge, TN 37831). pp 65-77 of Particle and photon interactions with surfaces. Gruen, D.M.; Krauss, A.R.; Pellin, M.J.; Young, C.E. New York, NY; Elsevier Science Pub. Co. Inc. (1987). (CONF-860807—). Contract AC05-84OR21400.

From 6. international workshop on inelastic ion surface collisions; Argonne, IL, USA (25 Aug 1986).

An overview is given of the use of low energy ion scattering as a probe of surface structure with emphasis on work done using alkali ions. Various schemes for extracting structural information from the ion energy and angle distribution are discussed in therms of advantages and disadvantages of each. The scattering potential, which is the primary nonstructural parameter needed for analysis, is discussed in terms of recent experimental results. The structures of clean and reconstructed surfaces are discussed, with examples of measurements of layer relaxations on the Mo (111) surface and missing row reconstructions on the Au (110) and Pt (110) surfaces. Studies of adsorbate covered surfaces are presented with respect to location of the adsorbate and its effect on the structure of the underlying substrate. Finally, examples are given which demonstrate the sensitivity of ion scattering to surface defects and disordering on reconstructed Au (110) and Pt (110) surfaces and reconstructed Mo (111) surfaces, and to ordering of adsorbates on Mo (001).

9081 **Helium production in copper by a thermal three-stage reaction.** Kneff, D.W.; Oliver, B.M.; Skowronski, R.P.; Greenwood, L.R.; Callis, E.L. (Rockwell International Corp., Canoga Park, CA, USA; Argonne National Lab., IL, USA). *Radiation Effects;* **93**: No. 1-4, 217-220(1986). (CONF-850507—).

From International conference on nuclear data for basic and applied science; Santa Fe, NM, USA (13 May 1985).

A three-stage reaction process has been identified in copper that produces significant ^{4}He concentrations at high thermal neutron fluences. Cross sections have been determined for four reactions that allow us to calculate the total ^{4}He production in copper for high-fluence irradiations in HFIR.

9082 **Strain-rate effects on the ductile/brittle transition in steels.** Knorovsky, G.A. (Sandia National Labs., Albuquerque, NM 87185). pp 569-596 of Fracture mechanics: Sixteenth symposium. Kanninen, M.F.; Hopper, A.T. Philadelphia, PA; ASTM (1985). (CONF-830820—). Contract AC04-76DP00789.

From 16. national symposium on fracture mechanics; Columbus, OH, USA (15 Aug 1983).

A recently implemented fracture control plan for structural steel highway bridges makes use of a linear relation to describe the effect of strain rate on the ductile/brittle transition temperature as a function of yield strength. Literature data show that the predictions of the aforementioned relation are not general. An alternative analysis is offered along with a qualitative model for understanding the phenomenon. Results of an experimental program investigating microstructural effects on the ductile/brittle strain rate dependence are also presented. The results exhibit linear behavior of ΔT/sub db/ versus $\Delta\sigma/\sigma$, where ΔT/sub db/ is the transition temperature shift, σ is the yield stress, and $\Delta\sigma$ is the change in yield stress caused by strain rate. The magnitude of the temperature shift, however, is dependent upon the test specimen used. Factors discussed include microstructure, type of test specimen (Charpy V-notch, nil ductility temperature [NDT], modified NDT, or compact toughness), crack initiation versus crack propagation, and implications for regulatory bodies.

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REFER ALSO TO CITATION(S) 8382, 8431, 8515, 8516, 8532, 9037, 9069, 9076, 9217, 9321, 9322, 10387, 10391, 10393, 10479, 10479, 10500

9083 **(CONF-870691—7) Nondestructive characterization of ceramic composite whiskers with neutron diffraction and ultrasonic techniques.** Kupperman, D.S.; Majumdar, S.; MacEwen, S.R.; Hitterman, R.L.; Singh, J.P.; Roberts, R.A.; Routbort, J.L. (Argonne National Lab., IL (USA)). Jul 1987. Contract W-31109-ENG-38. 17p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88003075/JAW.

From Review of progress in quantitative NDE; Williamsburg, VA, USA (21 Jun 1987).

This paper presents some results of a program in which the characterization and control of interfacial bonds in composites are being investigated. The General Purpose Powder Diffractometer (GPPD) at the Intense Pulsed Neutron Source (IPNS) have been employed to measure residual strains in Al_2O_3/SiC, ceramic-ceramic composite by neutron diffraction techniques from which stresses at the fiber-matrix interface may be calculated. Results of this experiment and initial results employing ultrasonic techniques to assess whisker-matrix bonding are discussed. 9 refs., 5 figs.

9084 **(CONF-870802—29) Fabrication of $YBa_2Cu_3O_7$ superconducting ceramics.** Poeppel, R.B.; Flandermeyer, B.K.; Dusek, J.T.; Bloom, I.D. (Argonne National Lab., IL (USA)). Jun 1987. Contract W-31109-ENG-38. 6p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88003012/JAW.

From 194. American Chemical Society national meeting; New Orleans, LA, USA (30 Aug 1987).

Recent experience concerning the preparation of $YBa_2Cu_3O_7$ powder and its fabrication into a variety of shapes is detailed. The fabrication techniques used were dry pressing, tape casting, and extrusion. Parameters found to affect superconductor quality are noted. 3 refs.

9085 **(CONF-870843—2) Embedded cluster models for electronic structure and energetics of complex oxides.** Ellis, D.E.; Lam, D.J. (Northwestern Univ., Evanston, IL (USA); Argonne National Lab., IL (USA)). 1987. Contract W-31109-ENG-38. 20p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88003097/JAW.

From International conference on electronic structure in phase stability in advanced ceramics; Argonne, IL, USA (17 Aug 1987).

Electronic structures and energetics of complex oxide systems have been investigated using the self-consistent embedded cluster model in the framework of local density theory. Ground state charge and spin distributions and energy level diagrams are generated for perfect host lattices, and for vacancy and impurity environments. Polarization response of perfect and defected lattice is explored by performing self-consistent calculations in the presence of an external electric field. Local multipolar moments are determined for quantitative analysis of the response of the system to the induced disturbances. Cohesive energies are calculated for molecular fragments, and are used to study relative energetics of the perfect host lattices and various defect structures with and without external applied electric field. Results obtained from oxide systems with NaCl-type structure, as well as rare-earth and alkali-earth stabilized cubic zirconia and superconducting La_2CuO_4, are presented and discussed. 23 refs., 1 fig., 3 tabs.

9086 **(CONF-870843—3) Valence determination in high T/sub c/ oxide superconductors by XANES [X-ray Absorption Near Edge Structure] and Moessbauer spectroscopy.** Alp, E.E.; Soderholm, L.; Shenoy, G.K.; Hinks, D.G.; Veal, B.W.; Montano, P.A. (Argonne National Lab., IL (USA); City Univ. of New York, NY (USA)). Sep 1987. Contract W-31109-ENG-38. 14p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88003100/JAW.

From International conference on electronic structure in phase stability in advanced ceramics; Argonne, IL, USA (17 Aug 1987).

The question of valence of Cu and rare-earth atoms in the newly discovered oxide superconductors with high transition temperatures is crucial to the understanding of their electronic structure. X-Ray Absorption Near Edge Structure and Moessbauer Spectroscopy were used to measure the valence of Cu, Pr, Eu, and Gd in La/sub 2-x/(Sr,Eu)/sub x/CuO_4 and (Y,Gd,Pr)Ba_2Cu_3O/sub 7-δ/. Results are presented, and the Cu valence as a function of oxygen concentration is discussed. 18 refs., 6 figs.

9087 **(CONF-870843—4) High-temperature charge-density studies of CeO/sub 2-x/ using x-ray and neutron diffraction techniques.** Faber, J. Jr. (Argonne National Lab., IL (USA)). Jul 1987. Contract W-31109-ENG-38. 22p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88002988/JAW.

From International conference on electronic structure in phase stability in advanced ceramics; Argonne, IL, USA (17 Aug 1987).

High-resolution Bragg scattering experiments have been used to study the structure of polycrystalline CeO/sub 2-x/. The in-situ experiments were carried out as a function of temperature ($300 < T < 1500°K$). The composition was controlled by flowing gases (CO/CO_2 or Ar/O_2 mixtures) over the sample. Results of both x-ray and neutron scattering experiments are used to define the principle atomic defects responsible for nonstoichiometry in CeO/sub 2-x/. Large lattice relaxation effects are observed whose magnitudes increase with increasing defect concentration. Temperature-dependent studies of the stoichiometric state ($x = 0$), show that lattice anharmonic interactions are important. The symmetry of the lattice anharmonic interactions is the same as the static displacements observed in the nonstoichiometric state. Thus, we propose that lattice anharmonic interactions are the fundamental driving force for the complex strain interactions observed in the nonstoichiometric state. 44 refs., 5 figs.

9088 **(CONF-870843—5) Thermodynamic and conductivity studies of nonstoichiometric cerium dioxide by coulometric titration: A simultaneous measurement.** Park, Jong-Hee. (Argonne National Lab., IL (USA)). Apr 1987. Contract W-31109-ENG-38. 18p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88003054/JAW.

From International conference on electronic structure in phase stability in advanced ceramics; Argonne, IL, USA (17 Aug 1987).

Simultaneous measurements of thermodynamic properties and electrical conductivity for constant compositions in nonstoichiometric cerium dioxide (CeO/sub2-x/) were carried out by coulometric titration in the temperature range 800 to 945°C and oxygen-partial-pressure range 10^{-19} to 10^{-21} atm. The electrochemical, constant-composition technique is used as a fast and direct method for obtaining thermodynamic data and simultaneous measurements of the electrical conductivity. 13 refs., 6 figs.

9089 **(CONF-870856—3) The use of NMR imaging to measure porosity and binder distributions in green-state and partially sintered ceramics.** Ackerman, J.L.; Garrido, L.; Ellingson, W.A.; Weyand, J.D. (Massachusetts General Hospital, Boston (USA). Radiology Dept.; Argonne National Lab., IL (USA); Aluminum Co. of America, Alcoa Center, PA. Alcoa Technical Center). Sep 1987. Contract W-31109-ENG-38. 34p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88003099/JAW.

From Conference on nondestructive testing of high performance ceramics; Boston, MA, USA (25 Aug 1987).

Nonuniformities in porosity or binder distribution in green-state ceramic compacts can lead to failure in the final densified material. NMR imaging is a nondestructive characterization technique, most commonly used in medical diagnosis, which we have adapted for the production of tomographic images of porosity and of binder distributions. We measure open porosity by the imaging of a suitable filler fluid introduced into the part by vacuum impregnation. Our results on partially sintered bodies show rough correlations with predicted porosity distributions. Binders with a high content of plasticizer may be imaged directly. Binder distributions with a plasticizer weight percent typical of those used in cold-pressing and injection molding cannot be imaged with conventional clinical or animal research instrumentation and methods. We have been successful in imaging such binders directly. We present results illustrating our techniques in a series of green-state and partially sintered aluminas. 26 refs., 12 figs., 1 tab.

9090 **(CONF-870873—19) Structural properties of high-T/sub c/ oxide superconductors.** Jorgensen, J.D. (Argonne National Lab., IL (USA)). Aug 1987. Contract W-31109-ENG-38. 22p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88002974/JAW.

From 18. conference on low temperature physics; Kyoto, Japan (20 Aug 1987).

Structural studies have played a key role in understanding the new oxide superconductors. Neutron powder diffraction techniques have been of particular importance because of the difficulty in synthesizing single crystals of the desired quality and compositions and because of the need to accurately determine the locations and site occupancies of the oxygen atoms. The electronic properties have been shown to depend in a critical way on the structural details of the Cu-O sublattices in these compounds. The La/sub 2-x/M/sub x/CuO/sub 4-y/ (M = Ba, Sr, Ca,...) structure contains a two-dimensional square planar Cu-O sublattice with weak bonding between the layers. The YBa_2Cu_3O/sub 7-x/ structure contains both two-dimensional and one-dimensional Cu-O sublattices, commonly referred to as "planes" and "chains." Closely-related non-superconducting phases which exhibit small differences in stoichiome-

try or symmetry have also been studied and have provided key insights into the close relationship between structure and superconductivity in these systems. 88 refs., 6 figs.

9091 **(CONF-870881—7) Coulomb interactions and effective strong coupling Hamiltonians in Cu-O superconductors.** Fedro, A.J.; Schuettler, H.B.; Sinha, S.K. (Argonne National Lab., IL (USA); Exxon Research and Engineering Co., Annandale, NJ (USA)). Aug 1987. Contract W-31109-ENG-38. 4p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88002942/JAW.

From 18. conference on superconductivity in highly correlated fermion systems; Sendai, Japan (31 Aug 1987).

We have studied the effects of virtual Cu-O charge fluctuations in the perovskite high-T/sub c/ materials by applying a strong coupling expansion to an extended Hubbard model with hybridized Cu d-orbitals and O p-orbitals. Results for charge fluctuation-mediated site-diagonal effective interactions are discussed. 6 refs.

9092 **(CONF-870955—1) Experimental aspects of high-T/sub c/ superconductors.** Gray, K.E. (Argonne National Lab., IL (USA)). Sep 1987. Contract W-31109-ENG-38. 13p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88003019/JAW.

From 3. workshop on RF superconductivity; Argonne, IL, USA (14 Sep 1987).

The discussion in this paper is restricted to the YBa_2Cu_3O/sub 7-x/ compound (denoted also as YBCO) which exhibits superconductivity at about 90°K, i.e., above liquid nitrogen temperature of 77°K, since such an increase in operating temperature seems to be the major reason for considering these materials for rf applications. We start with an overview of the various fabrication methods, which include bulk samples made by ceramic processing and thin films made by MBE/electron beam co-evaporation/co-sputtering/pulsed excimer laser evaporation/etc. Particularly interesting examples include single crystals and epitaxial thin films. Although these are not expected to be useful in cavity applications, they provide us with the best information on the intrinsic properties of the material, from which we can project its potential usefulness if these properties can be duplicated using more practical fabrication methods. This brief review will include examples of microstructure, traditional superconducting properties like T/sub c/, H/sub c2/ and J/sub c/, specific heat, thermal conductivity, photoemission, infrared(ir) reflectance, tunneling and Raman scattering. 37 refs., 8 figs.

9093 **(CONF-871124—3) Magnetic investigations of superconductive, polycrystalline $(RE)_2Ba_2Cu_3O$/sub 7-x/ compounds (RE = Y, Gd, Ho, Dy).** Thompson, J.R.; Boatner, L.A.; Brynestad, J.; Christen, D.K.; Kim, Y.C.; Sales, B.C.; Sekula, S.T. (Oak Ridge National Lab., TN (USA)). Oct 1987. Contract AC05-84OR21400. 5p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88002537/JAW.

From Fall meeting of the Materials Research Society; Boston, MA, USA (30 Nov 1987).

Magnetic properties have been investigated for several rare-earth based, polycrystalline samples of high T/sub c/ superconductive "123" compounds with magnetic onset temperatures between 90 and 95°K. Analysis of the susceptibility chi of samples based on Gd, Ho, and Dy indicates that the superconductive and magnetic properties are independent of one another to a substantial degree. 8 refs., 3 figs., 1 tab.

9094 **(CONF-871124—4) The charge state of iron ions implanted into sapphire.** McHargue, C.J.; Sklad, P.S.; White, C.W.; Farlow, G.C.; Perez, A.; Kornilios, N.; Marest, G. (Oak Ridge National Lab., TN (USA); Wright State Univ., Dayton, OH (USA); Lyon-1 Univ., 69 - Villeurbanne (France)). 1987. Contract AC05-84OR21400. 7p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88002527/JAW.

From Fall meeting of the Materials Research Society; Boston, MA, USA (30 Nov 1987).

Single crystals of α-Al_2O_3 were implanted with $^{57}Fe^+$ at room temperature to fluence ranging from 10^{16} to 10^{17} ions/cm^2. The damage in the implanted zone and the valence states and local environment of implanted ions were studied by transmission electron microscopy, Rutherford backscattering-channeling, and conversion electron Moessbauer spectroscopy. The implanted iron was distributed among the three charge states Fe^{3+}, Fe^{3+}, and Fe^0 (metallic clusters) with the relative amount of each varying with concentration of implanted iron. 16 refs., 3 figs., 1 tab.

9095 **(CONF-871124—5) Ionic models for $YBa_2Cu_3O_7$.** Wright, N.F.; Painter, G.S.; Busing, W.R.; Butler, W.H. (Oak Ridge National Lab., TN (USA)). 1987. Contract AC05-84OR21400. 5p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88002613/JAW.

From Fall meeting of the Materials Research Society; Boston, MA, USA (30 Nov 1987).

Simple ionic models are applied to $YBa_2Cu_3O_7$. It is found that additional forces are needed to constrain the barium and the planar coordinated copper atoms to be stable in their observed positions. These additional forces are compared to forces calculated from first principles. It is observed that the restoring forces are small for motion of the "in chain" oxygen atoms perpendicular to the chains.

9096 **(CONF-871126—7) Low field characterization of YBa_2Cu_3O/sub 7-δ/ single crystals.** Claus, H.; Crabtree, G.W.; Liu, J.Z.; Kwok, W.K.; Umezawa, A. (Illinois Univ., Chicago (USA); Argonne National Lab., IL (USA)). Oct 1987. Contract W-31109-ENG-38. 15p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88002895/JAW.

From 32. conference on magnetism and magnetic materials; Chicago, IL, USA (9 Nov 1987).

Low field magnetization measurements in fields from zero to 100 Oe at temperatures from 4.2 to 100°K on single crystals of YBa_2Cu_3O/sub 7-δ/ are presented. The crystals have sharp inductive transitions at 91.5°K occasionally with additional structure suggesting a second phase with a lower T/sub c/. For all crystals in all directions the Meissner effect is a small fraction of the shielding effect. Low field measurements of H/sub c2/ within 1 K of T/sub c/ show a linear temperature dependence with a slope of 80 Oe/K, much smaller than observed at higher field. 9 refs., 5 figs.

9097 **(CONF-8704231—3) Focused ultrasonic backscatter technique for near-surface flaw detection in structural ceramics.** Roberts, R.A. (Argonne National Lab., IL (USA)). Jun 1987. Contract W-31109-ENG-38. 13p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88003112/JAW.

From 16. symposium on nondestructive evaluation; San Antonio, TX, USA (21 Apr 1987).

This paper describes a focused ultrasonic backscatter technique that is currently being used at Argonne for the detection of near-surface flaws in ceramic modulus-of-rupture (MOR) bars. The technique exploits the generation of leaky surface waves in such a way that precise transducer positioning is not critical; for this reason, it is a potential candidate for the inspection of curved surfaces. Included in the presentation of results are the detection of near-surface flaws in Si_3N_4 MOR bars, and a correlation of NDE and fractography results after failure in four-point bending. 5 refs., 7 figs.

9098 **(CONF-8706125—20) Microstructure modifications of micron thick NbN films to improve J/sub c/ and H/sub c2/.** Kampwirth, R.T.; Gray, K.E.; Capone, D.W. II; Murduck, J.M.; Lingevitch, J.F. (Argonne National Lab., IL (USA)). Jul 1987. Contract W-31109-ENG-38. 6p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88003078/JAW.

From Conference on advances in cryogenic engineering; St. Charles, IL, USA (14 Jun 1987).

NbN films have been shown to be good candidate conductors for high field superconducting magnet applications. This paper examined various preparation techniques which could enhance the critical current density J/sub c/ and upper critical field H/sub c2/ of NbN films made by magnetron sputtering. Decreasing film thickness to reduce average grain diameter had little or no effect on J/sub c parallel/, but did increase J/sub c perpendicular/. Layering NbN with thin insulating layers of aluminum nitride resulted in significant increases in J/sub c parallel/.

9099 **(CONF-8709135—6) Soft x-ray absorption and emission spectra and the electronic structure of the $Ba_2YCu_3O_{7-x}$ superconductor.** Tsang, K.L.; Zhang, C.H.; Callcott, T.A.; Canfield, L.R.; Ederer, D.L.; Blendell, J.E.; Clark, C.W.; Wassdahl, N.; Rubensson, J.E.; Bray, G. (Tennessee Univ., Knoxville (USA); National Bureau of Standards, Washington, DC (USA); Uppsala Univ. (Sweden); Lund Univ. (Sweden); Hamburg Univ. (Germany, F.R.)). 1987. Contract AC05-84OR21400. 6p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88002609/JAW.

From 14. international conference on X-ray and inner-shell processes; Paris, France (14 Sep 1987).

We present e-beam excited soft x-ray emission spectra and total photoelectron yield spectra in the 20 to 600 eV photon energy range for the $Ba_2YCu_3O_{7-x}$ superconductor. We confirm the 2+ valency of Cu in the compound by total yield measurements. In soft x-ray emission, the N/sub 4.5/ spectrum of Ba, the M/sub 4.5/ spectrum of Y, and the K spectrum of O provide measures of the p-type partial density of states (p-PDOS) localized on the respective atomic sites. In each case the p-PDOS is very small at the Fermi energy with the first peak in the p-PDOS lying 3.5 to 4 eV below the Fermi energy. The K spectra of O confirm the interpretation that the structure observed in the photoemission measurements are associated with the O 2p orbitals. Finally no changes are observed between spectra taken above and below T/sub c/. 20 refs., 4 figs.

9100 **(CONF-8709188—1) The effect of varying sputtering parameters on the microstructure and mechanical properties of 10%Ni + TiB_2 thin films.** Parrish, R.H.; Wert, J.J.; Oliver, W.C.; Sklad, P.S. (Vanderbilt Univ., Nashville, TN (USA). Dept. of Mechanical and Materials Engineering). 1987. Contract AC05-84OR21400. 8p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88002600/JAW.

From 7. international conference on erosion by liquid and solid impact; Cambridge, UK (7 Sep 1987).

Thin refractory coatings have been demonstrated to deter solid particle erosion. A detailed examination of the microstructures of 10%Ni + TiB_2 with varying sputtering parameters was undertaken by the use of transmission electron microscopy. Advanced instrumentation was then used to determine the micromechanical and macromechanical properties of these coatings. Microstructures, nanoindentation hardness values and moduli of elasticity were compared to obtain a better understanding of the role of sputtering parameters in determining coating performance. 14 refs., 8 figs., 2 tabs.

9101 **(CONF-8710219—1) Oxygen diffusion in high T/sub c/-superconductors.** Routbort, J.L.; Rothman, S.J.; Flandermeyer, B.K.; Nowicki, L.J.; Baker, J.E. (Argonne National Lab., IL (USA); Illinois Univ., Urbana (USA). Materials Research Lab.). 1987. Contract W-31109-ENG-38. 12p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88002965/JAW.

From Symposium on diffusion processes in high technology materials; Cincinnati, OH, USA (12 Oct 1987).

Diffusion of ^{18}O in the superconductor La/sub 2-x/Sr/sub x/CuO/sub 4-y/ has been measured as a function of x (0 to 0.20) between 300 and 500°C at an oxygen partial pressure $\approx$1 atm. Concentration profiles were obtained using a secondary ion mass spectrometer. The diffusion coefficient decreases with increasing Sr additions from 0.1 to 0.2, primarily because of an increase in activation energy. This result, which is contradictory to the expectation that the diffusion coefficient should increase with increasing vacancy concentration caused by the added Sr, can be explained if oxygen vacancies are bound to Sr clusters. The diffusion coefficients in samples with x = 0 or 0.05 and in the 93°K superconductor $YBa_2Cu_3O_{7(1-\delta)}$ could not be determined, probably because of penetration of oxygen along macroscopic defects. 19 refs., 6 figs., 2 tabs.

9102 **(EUR—9156) Cobalt oxide spectral selective coatings: Final report and supplement to final report.** Boose, C.A.; van der Leij, M. (Nijverheidsorganisatie TNO, The Hague (Netherlands)). 1985. 160p. NTIS (US Sales Only), PC A08/MF A01. Order Number DE88900224/JAW.

Aim of the work was to develop a highly spectral selective absorber surface based on cobalt oxide, which is thermally stable up to 500°C both in air and in vacuum, with a relatively high corrosion resistance and which is attractive for economic application. Two types of cobalt oxide coatings have been developed with different properties as to spectral selectively, thermal stability, corrosion resistance and production processes: (1) Co/Fe (III) oxide on Ni, produced by flame or furnace oxidation of electroplated Co/Fe(III) on bright plated Ni. (2) Co/Mo oxide on Ni, produced by electrochemical oxidation of electroplated Co/Mo on bright plated Ni. Other alloying elements, such as W and Cr, were investigated to improve the durability. A diffusion barrier layer with Pd and Cr in between the substrate and the cobalt coating did not significantly improve the stability. Some outdoor testing of the above mentioned surfaces supplied on different collector types has given results on stagnation temperatures as could be expected with similar selective surfaces of other origin. 17 refs., 42 figs., 41 tabs.

9103 **(EUR—10389) Ceramic materials from molten blast-furnace slag by direct controlled cooling: Final report.** Rogers, P.S.; Williamson, J.; Bell, J.F.; Campbell, M. (Imperial Coll. of Science and Technology, London (UK). Dept. of Metallurgy and Materials Science). 1986. 101p. NTIS (US Sales Only), PC A06/MF A01. Order Number DE88900232/JAW.

Objective of the research program was to develop a pilot-plant facility to produce glass-ceramic ('Silceram') by a novel process. In this, a silicate melt was converted to a fine-grained pore-free ceramic during a controlled-cooling heat treatment, removing the need for reheating. The new heat-treatment program offers a substantial saving in thermal energy. The new material had superior mechanical properties. These were extensively studied in laboratory tests, as functions of microstructure and chemical composition. The crystal size of the major silicate phase was about 2 μm and the porosity was close to zero. The high strength and hardness are associated with excellent resistance to erosion by fluid-borne particle. 9 figs., 13 tabs.

9104 (INIS-BR—903, pp 483-487) **A-Si:H prepared by magnetically assisted dc-Sputtering.** Koropecki, R.; Cutrera, M.; Arce, R.; Buitrago, R. (Consejo Nacional de Investigaciones Cientificas e Tecnicas, Santa Fe, Argentina). 1984. NTIS (US Sales Only), PC A12/MF A01. Order Number DE88700663/JAW. (CONF-8402101—).

From Simposio Latino-Am. de Fis. dos sistemas amorfos; Niteroi, Brazil (1 Feb 1984).

We described a high pressure reactive dc-sputtering system for a-Si:H deposition. Optical and electrical transport measurement were performed in order to characterize the films. Results of dark and photoconductivity as a function of temperature and hydrogen content, and optical gap dependence on hydrogen content are present. (M.W.O.).

9105 (INIS-BR—903, pp 492-495) **Deposition and characterization of a-Si:H thin films obtained from RF Glow discharge of SiH/sub 4/ and He mixture.** Constantino, C.; Santos, P.V.; Brenzikofer, R.; Chambouleyron, I. (Universidade Federal Fluminense, Niteroi, Brazil. Inst. de Fisica). 1984. (In Portuguese). NTIS (US Sales Only), PC A12/MF A01. Order Number DE88700663/JAW. (CONF-8402101—).

From Simposio Latino-Am. de Fis. dos sistemas amorfos; Niteroi, Brazil (1 Feb 1984).

Preliminary results on deposition and characterization of hydrogenated amorphous silicon thin films are presented. These films were produced by the RF Glow Discharge procedure. The RF power applied and the He:SiH/sub 4/ proportion were varied in the deposition chamber. The increasing rate, the absorption coefficient, the optical gap and the electrical conducivity as a function of temperature were studied. It was verified that inside the studied range, those properties are, with the exception of the increasing rate weakly dependent of the deposition conditions.

9106 (INIS-BR—903, pp 496-499) **Relation between the properties of hydrogenated and nitrogenated amorphous silicon thin films and the chemical composition of the work atmosphere.** Vilche, A.; Brenzikofer, R. (Universidade Federal Fluminense, Niteroi, Brazil. Inst. de Fisica). 1984. (In Portuguese). NTIS (US Sales Only), PC A12/MF A01. Order Number DE88700663/JAW. (CONF-8402101—).

From Simposio Latino-Am. de Fis. dos sistemas amorfos; Niteroi, Brazil (1 Feb 1984).

Four sets of five films of a-Si:H:N were developed on glass using the RF glow discharge procedure in a sylane and nitrogen (N/sub 2/) atmosphere with several concentrations. The samples were analysed through optical transmission for the determination of the thickness, refraction index, optical gap using a program inserted in a VAX-II system. The films were characterized by electrical conductivity measurement as function of temperature with the aim of determining the activation energy.

9107 (INIS-BR—903, pp 500-502) **Amorphous silicon films with BF/sub 3/ and PF/sub 5/ additions.** Ortiz, A.; Muhl, S.; Sauchez, A.; Monroy, R.; Pickin, W. (Universidad Nacional Autonoma de Mexico, Mexico City. Inst. de Investigaciones en Materiales). 1984. (In Spanish). NTIS (US Sales Only), PC A12/MF A01. Order Number DE88700663/JAW. (CONF-8402101—).

From Simposio Latino-Am. de Fis. dos sistemas amorfos; Niteroi, Brazil (1 Feb 1984).

Using the glow discharge procedure, hydrogenated amorphous silicon a-Si:H thin production, several temperature and plasma conditions were analysed. (M.W.O.).

9108 (INIS-mf—11054, pp 53) **Low temperature calorimetry on Tm,Tm-H/sub x/ and Tm-D/sub 0.1/.** Hilscher, G.; Pillmayr, N.; Vajda, P.; Daou, J.N. (Technische Univ., Vienna, Austria. Inst. fuer Experimentalphysik; Centre National de la Recherche Scientifique, 91 - Orsay, France). Sep 1987. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88700772/JAW. (CONF-8709196—).

From Annual convention fo the Austrian Physical Society; Vienna, Austria (21 Sep 1987).

9109 (INIS-mf—11054, pp 44) **Sputter layers of superconducting ternary oxides.** Leising, G.; Leitner, O.; Kranebitter, P. (Technische Univ., Graz, Austria. Inst. fuer Festkoerperphysik; Siemens Bauelemente OHG,Deutschlandsberg, Austria). Sep 1987. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88700772/JAW. (CONF-8709196—).

From Annual convention fo the Austrian Physical Society; Vienna, Austria (21 Sep 1987).

9110 (INIS-mf—11054, pp 42) **X-ray structure determination of high-temperature superconductors.** Leitner, O.; Leising, G. (Technische Univ., Graz, Austria. Inst. fuer Festkoerperphysik). Sep 1987. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88700772/JAW. (CONF-8709196—).

From Annual convention fo the Austrian Physical Society; Vienna, Austria (21 Sep 1987).

9111 (INIS-mf—11054, pp 42) **Electron microscopic investigations of superconducting oxides .** Leising, G.; Poelt, P.; Golob, P. (Technische Univ., Graz, Austria. Inst. fuer Festkoerperphysik; Zentrum fuer Elektronenmikroskopie,Graz, Austria). Sep 1987. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88700772/JAW. (CONF-8709196—).

From Annual convention fo the Austrian Physical Society; Vienna, Austria (21 Sep 1987).

9112 (INIS-mf—11054, pp 41) **High temperature superconductors.** Eibler, R.; Bauer, E. (Technische Univ., Vienna, Austria. Inst. fuer Experimentalphysik). Sep 1987. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88700772/JAW. (CONF-8709196—).

From Annual convention fo the Austrian Physical Society; Vienna, Austria (21 Sep 1987).

9113 (INIS-mf—11054, pp 41) **Electric transport properties of high-temperature superconductors.** Leising, G.; Kazmin, S.; Pang, J. (Technische Univ., Graz, Austria. Inst. fuer Festkoerperphysik). Sep 1987. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88700772/JAW. (CONF-8709196—).

From Annual convention fo the Austrian Physical Society; Vienna, Austria (21 Sep 1987).

9114 (INIS-mf—11054, pp 43) **ESR-susceptibility-and hysteresis investigations in YBaCuO and substitution variants.** Czaputa, R.; Leising, G. (Graz Univ., Austria; Technische Univ., Graz, Austria. Inst. fuer Festkoerperphysik). Sep 1987. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88700772/JAW. (CONF-8709196—).

From Annual convention fo the Austrian Physical Society; Vienna, Austria (21 Sep 1987).

9115 (INIS-mf—11054, pp 43) **Optical investigations on high-temperature superconductors.** Leising, G.; Filzmoser, M.; Herz, B. (Technische Univ., Graz, Austria. Inst. fuer Festkoerperphysik). Sep 1987. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88700772/JAW. (CONF-8709196—).

From Annual convention fo the Austrian Physical Society; Vienna, Austria (21 Sep 1987).

9116 (INIS-mf—11054, pp 44) **Raman scattering on superconducting layer perovskides.** Knoll, P.; Gassler, W.; Kiefer, W.; Leising, G. (Graz Univ., Austria; Technische Univ., Graz, Austria. Inst. fuer Festkoerperphysik). Sep 1987. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88700772/JAW. (CONF-8709196—).

From Annual convention fo the Austrian Physical Society; Vienna, Austria (21 Sep 1987).

9117 (INIS-mf—11054, pp 52) **Temperature-and structure dependence of electric conductivity and magnetic susceptibility of metal oxides.** Gruber, H.; Krautz, E.; Gatterer, K.; Fritzer, H.P. (Technische Univ., Graz, Austria. Inst. fuer Festkoerperphysik; Technische Univ., Graz, Austria. Inst. fuer Physikalische und Theoretische Chemie). Sep 1987. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88700772/JAW. (CONF-8709196—).

From Annual convention fo the Austrian Physical Society; Vienna, Austria (21 Sep 1987).

9118 (INIS-mf—11054, pp 54) **Specific heat measurements on (RE/sub x/Y/sub 1-x/)Co/sub 2/ compounds.** Pillmayr, N.; Hilscher, G.; Schmitzer, C.; Gratz, E. (Technische Univ., Vienna, Austria. Inst. fuer Experimentalphysik). Sep 1987. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88700772/JAW. (CONF-8709196—).

From Annual convention fo the Austrian Physical Society; Vienna, Austria (21 Sep 1987).

9119 (LBL—22075, pp 33-44) **Ceramic and metal interfaces.** Apr 1987. NTIS, PC A06/MF A01. Order Number DE88000686/JAW.

In Center for Advanced Materials: Annual report, 1986.

The servicability of many structural and electrical components and assemblies hinges on good ceramic-metal bonding where failure of the interface will lead to loss of electrical continuity, protection against wear or corrosion, or other service function. Thus, development of a mechanical theory of adherence between dissimilar materials and demonstration of the metallurgical principles to achieve superior resistance to decohesion are the primary goals of this program. The program currently has four primary foci: ceramic-metal interfacial fracture energies; internal stress-induced film de-

lamination; delamination of reactively formed coatings; and indentation-induced film delamination. 23 refs., 7 figs.

9120 (LBL—22836) Nb_3Al formation in sputter-deposited Nb/Al multi-layer samples. Im, Yoonsoon; Johnson, P.E.; McKnelly, L.T. Jr.; Morris, J.W. Jr. (Lawrence Berkeley Lab., CA (USA)). Nov 1987. Contract AC03-76SF00098. 21p. (CONF-870272—11). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88003192/JAW.

From American Institute of Metallurgical Engineers annual meeting: light metals session; Denver, CO, USA (22 Feb 1987).

The critical current density of powder metallurgy processed wires is determined in part by the extent of the A15 phase formation in the vicinity of the Nb/Al interface. A series of multi-layered samples was made to simulate the reactions in the P/M wires. Transmission electron microscopy was used to study the reactions between the multi-layers. Results indicate that the reactions at the Nb/Al interface depend strongly on the Nb and Al layer thickness and distribution. No evidence of the metastable NbAl solid solution formation was found. It is concluded that the Nb_3Al and the residual Nb present in the reacted P/M wires can be avoided if the Nb and Al layers are sufficiently thin and uniformly distributed with the proper stoichiometry. 10 refs., 7 figs., 2 tabs.

9121 (LBL—23131) TiN coatings on M2 steel produced by plasma assisted chemical vapor deposition. Hilton, M.R.; Vandentop, G.J.; Salmeron, M.; Somorjai, G.A. (Lawrence Berkeley Lab., CA (USA)). 3 Sep 1987. Contract AC03-76SF00098. 20p. (CONF-870388—15). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88003189/JAW.

From International conference on metallurgical coatings; San Diego, CA, USA (23 Mar 1987).

TiN films were deposited onto M2 steel using plasma-assisted chemical vapor deposition. $TiCl_4$, N_2 and H_2 were the reactant gases used at 1 torr. A plasma was essential for TiN formation at 500°C and below. At 500°C, a highly crystalline stoichiometric TiN coating was formed with a (200) surface orientation and having a columnar Zone 2 grain structure. At 400°C, a Zone T structure with an additional amorphous component was observed. Both types of films had good adherence with scratch adhesion critical loads comparable to values for sputtered TiN. The Zone 2 films failed by cracking and occasional chipping within the coating. The Zone T films failed by cracking in the coating and by chipping, within the coating and by the interface. AES depth profiling of thin films indicates that the interface was sharp and no accumulation of Cl is observed. AES and SEM suggest that distinct TiN islands or nuclei are present in the early stages of growth. The use of an organometallic source, titanium tetrakis (dimethylamide), resulted in the formation of carbonitride powders. 17 refs., 4 figs.

9122 (LBL—24094) On the coexistence of phonon and non-phonon (plasmon) mechanisms in new high T/sub c/ superconductors. Kresin, V.Z. (Lawrence Berkeley Lab., CA (USA)). Jul 1987. Contract AC03-76SF00098. 3p. (CONF-8707109—1). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88003188/JAW.

From Adriatico conference on high temperature superconductors; Trieste, Italy (6 Jul 1987).

An analysis of recent experimental data shows that high T/sub c/ is due to the coexistence of phonon and non-phonon mechanisms. 8 refs.

9123 (SAND—87-1488C) Control of etching of $LiNbO_3$ by implant damage profile tailoring. Brannon, P.J.; Ashby, C.I.H.; Arnold, G.W. (Sandia National Labs., Albuquerque, NM (USA)). 1987. Contract AC04-76DP00789. 8p. (CONF-871124—13). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88003211/JAW.

From Fall meeting of the Materials Research Society; Boston, MA, USA (30 Nov 1987).

Damage-profile tailoring using multi-energy ion implants produced smooth side walls and deeper etched features with ion-bombardment-enhanced wet etching of $LiNbO_3$ than was possible with a single-energy implant. High ion fluences produced buried microcracks which may contribute to propagation losses commonly observed in ion-implanted waveguides. 5 refs., 6 figs., 1 tab.

9124 (N—87-29678) Joining of ceramics for high temperature applications. Vilpas, M. (National Aeronautics and Space Administration, Washington, DC (USA)). Oct 1987. Translation of Korkeissa Lampotiloissa Kaytettavien Keraamisten Materiaalien Liittaminen, (Espoo, Finland), Aug. 1985, 1-37. (NASA-TT—20030; NAS—1.77:20030; VTT-TIED—481). 28p. NTIS, PC A03/MF A01.

Summarized is a literature survey of the methods for joining ceramics to ceramics or ceramics to metals for high temperature applications. Also mechanical properties and potential applications of the joints are considered. The joining of ceramics is usually carried out by brazing or diffusion bonding. Especially the latter has been found useful, increasing the application of bonded ceramics. The possibility of using electron beam and laser beam welding for joining ceramics has also recently been investigated. The bonding of ceramics has found numerous applications typical for high operating temperatures, i.e., sensors and thermocouples.

9125 Photoemission spectroscopy of YBa_2Cu_3O/sub 6+x/. Brown, F.C.; Chiang, T.C.; Friedmann, T.A.; Ginsberg, D.M.; Kwawer, G.N.; Miller, T.; Mason, M.G. (Univ. of Illinois, Urbana). *Journal of Low Temperature Physics;* 69: No. 1-2, 151-156(Oct 1987). Contract AC02-76ER01198.

High-resolution angle-integrated photoemission measurements were made on a sample of the compound $Y_1Ba_2Cu_3O$/sub 6+x/, for which it was shown that the onset of superconductivity was as high as 93 K. The density of states associated with the Cu 3d levels appears in an intense band about 4 eV wide beginning about 1.5 eV below the Fermi level. A small wing of this band extends up to the Fermi level, where the density of states is relatively low. These results are in good agreement with the projected density of states of Cu as obtained in recent calculations.

9126 Parametric amplification in AgGaSe/sub 2/. Barnes, N.P.; Gettemy, D.J.; Hietanen, J.R.; Iannini, R.A. (NASA Langley Research Center, Hampton, VA 23665). pp 208-210 of Proceedings of the conference on lasers and electro-optics. Piscataway, NJ; IEEE Service Center (1987). (CONF-870401—).

From OSA/IEEE conference on lasers and electro-optics (CLEO '87); Baltimore, MD, USA (27 Apr 1987).

Technical Paper THA3.

Significant parametric amplification of mid-IR radiation has been demonstrated in specially annealed AgGaSe/sub 2/ crystals at relatively low-peak-power densities. It has been recognized that the AgGaSe/sub 2/ could be a useful nonlinear crystal, especially in situations where high average power is of interest. However, this crystal has suffered from poor optical quality, primarily precipitates which have limited the optical transmission. A postgrowth annealing process has been developed which solves the precipitate problem. Using an annealed crystal with a 20-mm length and a Ho:YAG laser as a pump, a gain at 3.39 μm of 2.9 has been measured with a peak pump density of only 8 MW/cm/sup 2/. Details and results of the annealing process as well as gain, tuning, and crystal homogeneity measurements with comparison to derived models of high-gain Gaussian beams are presented.

9127 Phase-matched harmonic generation in single microcrystals. Velsko, S.P. (Lawrence Livermore National Lab., Nonlinear Optical Materials Group, P.O. Box 5508, Livermore, CA 94550). pp 84-86 of Proceedings of the conference on lasers and electro-optics. Piscataway, NJ; IEEE Service Center (1987). (CONF-870401—).

From OSA/IEEE conference on lasers and electro-optics (CLEO '87); Baltimore, MD, USA (27 Apr 1987).

Technical Paper TUHH4.

The phase-matched harmonic generation parameters determining the conversion efficiency of a nonlinear material are the effective nonlinear coupling, angular sensitivity, and temperature bandwidth. The authors developed a method for directly measuring second harmonic generating efficiencies in single crystals as small as 300 μm. This obviates the necessity for more than a cursory attempt at crystal growth for many potentially interesting materials. They applied this method to evaluating the harmonic generating potential of a number of new nonlinear materials available only as submillimeter crystallites. This technique makes possible the rapid

evaluation of new nonlinear materials produced by the simplest solution growth or high-temperature methods. In addition, it is particularly well suited to characterizing small crystals produced by recently introduced fiber pulling techniques.

9128 **Imaging techniques utilizing optical fibers and tomography.** Wilke, M.; King, N.S.P.; Gray, N.; Johnson, D.; Esquibel, D.; Nedrow, P.; Ishiwata, S. (Physics Div., Univ. of California, Los Alamos National Lab., Group P-15, Mail Stop D406, P.O. Box 1663, Los Alamos, NM 87545). pp 185-192 of Fiber optic and laser sensors III. Moore, E.L.; Ramer, O.G. Bellingham, WA; SPIE Society of Photo-Optical Instrumentation Engineers (1985). (CONF-850887—).

From SPIE international technical symposium on optical and electro-optical engineers; San Diego, CA, USA (18 Aug 1985).

Tow-dimensional, time-dependent images generated by neutrons, gamma rays, and x-rays incident on fast scintillators are relayed to streak and video cameras over optical fibers. Three dimensions, two spatial and one temporal, have been reduced to two, one in space and time utilizing sampling methods permitting reconstruction of a time-dependent, two-dimensional image subsequent to data recording. The manner in which the sampling is done optimized the ability to reconstruct the image via a maximization of entropy algorithm. This method uses four linear fiber optic arrays typically 30 meters long and up to 35 elements each. A further refinement of this technique collapses the linear array information into four single fibers by wavelength multiplexing. This permits economical transmission of the data over kilometer distances to the recording equipment.

9129 **Statistical analysis of size and stress state effects on the strength of an alumina ceramic.** Shetty, D.K.; Rosenfield, A.R.; Duckworth, W.H. (Battelle-Columbus Labs., Columbus, OH 43201). pp 57-80 of Methods for assessing the structural reliability of brittle materials. Freiman, S.W.; Hudson, C.M. Philadelphia, PA; ASTM (1984). (CONF-8212116—).

From ASTM symposium on methods for assessing the structural reliability of brittle materials; San Francisco, CA, USA (13 Dec 1982).

Fracture strengths of an alumina ceramic, surface-finished to obtain an isotropic flaw population, were evaluated in inert and water environments in three qualified tests - four-point and three-point bend tests and a biaxial flexure test featuring uniform-pressure loading of disk specimens. The resulting strengths were examined in terms of a statistical fracture theory that employed fracture criteria derived from fracture mechanics theory and supported by reported experimental results on the fracture from angled surface cracks from indentation. The four-point and three-point bend tests gave fracture strengths, in both inert and water environments, that were consistent with the size effect predicted by the statistical fracture theory. The stress state effect on strength, as indicated by the results of the biaxial test, was predicted by the theory only for thE tests in water. The inert biaxial strengths were significantly greater than the statistical theory prediction, irrespective of the fracture criteria employed. The differences in the biaxial strengths predicted from the theory, on the bases of a normal stress (Mode I) and a combined mode fracture criteria, were small because of the relatively small values of the strength scatter in each test. The observed trend in the biaxial fracture strengths in relation to the uniaxial strengths with the change in the test environment suggested more severe strength degradation from slow-crack growth in the biaxial stress state than that in theuniaxial stress state. Implications of this result with respect to long-term reliability of brittle structural components are discussed.

3606 Other Materials

REFER ALSO TO CITATION(S) 8425, 8513, 8525, 8531, 8633, 8635, 8649, 8652, 8703, 8704, 8705, 8951, 8983, 9017, 9037, 9083, 9126, 9127, 9199, 9225, 9229, 10317, 10335, 10380

9130 **(AD-A—184629/4/XAB) Capless rapid thermal annealing of Si^+-implanted InP.** Woodhouse, J.D.; Gaidis, M.C.; Donnelly, J.P.; Arimento, C.A. (Massachusetts Inst. of Tech., Lexington (USA). Lincoln Lab.). 20 Jul 1987. 4p. (JA—5973). NTIS, PC A02/MF A01.

Pub. in Applied Physics Letters, Vol. 51, No. 3, 186-188(20 Jul 1987).

An enhanced-overpressure capless annealing technique suitable for annealing ion-implanted InP at temperatures of 900 C is described. The technique utilizes a Sn-coated InP wafer and is based on the same principle as the In-Sn-P liquid-solution method for eliminating InP surface degradation prior to epitaxial growth. InP samples implanted with 140-keV, 10^{14} power/sq. cm Si^+ and annealed at 900 C for 10 s exhibited improved electrical characteristics over samples annealed at 750 C for 5 min using conventional encapsulation techniques.

9131 **(AERE-R—12026) Investigation of the major and minor constituents of lithium niobate waveguides.** Read, P.M.; Speakman, S.P.; Hudson, M.D. (UKAEA Atomic Energy Research Establishment, Harwell. Nuclear Physics Div.). Feb 1986. 28p. H.M. Stationery Office, London, price Pound 5.00.

A wide range of analytical techniques has been utilized to investigate the concentration and location of major and minor constituents in lithium niobate at various stages of the titanium in-diffusion process. The applicability of various techniques is considered and results obtained by different techniques are compared. Whilst the techniques examined are all highly complementary a number have been identified as having particular value in the field of lithium niobate waveguides. These include secondary ion mass spectrometry, elastic recoil detection analysis and Rutherford backscattering spectrometry.

9132 **(CEA-LETI-MSC—1531) Hardening of MOS structures by tunnel injection under high electric field.** El Sayed, M. (CEA Centre d'Etudes Nucleaires de Grenoble, 38 (France). Lab. d'Electronique et de Technologie de l'Informatique). Apr 1987. 55p. (In French). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88750657/JAW.

The use of high electric field tunnel injection is studied in this report together with the induced shifts between threshold voltage and injection voltage, of a characterization method of hardening and traps. The method allows to find trap density and cross section.

9133 **(CEA-R—5387) Study of the low pressure (Black Phase) SmS properties.** Bordier, G. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Inst. de Recherche Technologique et de Developpement Industriel (IRDI)). Mar 1987. 169p. (In French). NTIS (US Sales Only), PC A08/MF A01. Order Number DE88751570/JAW.

SmS has been studied for its transition from the low pressure black phase to the high pressure intermediate valence phase; but the black phase properties seem to be very rich. The variations which pressure of the low-temperature electronic transport properties show the existence of a semi-metallic phase within the black phase domain in a pressure-temperature diagram, for a pressure above 4 kbar, which corresponds to the so-called B'phase. We study the insulating low pressure phase with a model involving acceptor like states. Using electronic paramagnetic resonance experiments we observe a square symmetry trivalent samarium ion neighbour of a sulfure defect, and magnetically coupled with the lattice. This defect exists in two nearly symmetric configurations and the resonance line broadens with temperature in an actived way. It gives rise to metastable effects yielding conductivity relaxations, analysed with stretched exponential laws, because the defect traps magnetically conduction electrons forming a bound magnetic polaron. The relaxation time at zero field is temperature actived. We develop a phenomenological model that gives the good orders of magnitude for the trapping barrier and for the critical field corresponding to the maximum of the low temperature magnetoresistance.

9134 (CEA-R—5396) Structure and dynamics of organized phases from sodium DI-2-ethylhexyl phosphate. Faure, A. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Dept. de Physico-Chimie). May 1987. 215p. (In French). NTIS (US Sales Only), PC A10/MF A01. Order Number DE88751572/JAW.

Some of the organized phases formed by the ternary system NaDEHP/water/benzene have been identified and characterized by means of phosphorous NMR, light scattering neutron and X-rays diffraction. A Mn/sup 2+/ ion, fixed to the phosphate head, induces on the surfactant molecules on one hand, on the solvent ones on the other hand a relaxation the measurements of which leads to the different conformers probabilities and the solvent penetration to the micelle. The treatment of the surfactant nuclei relaxation (/sup 31/P, /sup 13/C, /sup 1/H, and /sup 2/H) at various field allows the determination of the different molecular motions as well as the segmental motions of the chains and the order parameters of the C-H bonds. These ones, interpreted in terms of molecular geometry provide the orientation of the local director.

9135 (CONF-870893—5) Neutron- and x-ray-small angle scattering with Fe-base metallic glasses. Lamparter, P.; Steeb, S.; Kroeger, D.M.; Spooner, S. (Oak Ridge National Lab., TN (USA); Max-Planck-Institut fuer Metallforschung, Stuttgart (Germany, F.R.). Inst. fuer Werkstoffwissenschaften). 1987. Contract AC05-84OR21400. 10p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88002538/JAW.

From 6. international conference on rapidly quenched metals; Montreal, Canada (3 Aug 1987).

Small angle neutron, as well as x-ray-scattering experiments have been performed with the metallic glasses $Fe_{80}B_{20}$ and $Fe_{80}B_{16}Si_2C_2$. The amorphous ribbons were investigated in the as-quenched state and after relaxation anneals well below the crystallization temperatures where the materials undergo a ductile-brittle transition. The observed scattering effects reveal small structural inhomogeneities as well as extended fluctuations on a scale up to at least some thousand A, which both can be identified as concentration fluctuations. Inner surfaces or one-dimensional regions are suggested as sites for segregation of the metalloid atoms and impurities as well as sites favouring nucleation of crystallites. These processes, already taking place during the solidification, are enhanced by low temperature anneals, thus causing embrittlement of the amorphous material. 7 refs., 4 figs.

9136 (CONF-871189—1) Microstructures and properties of SiC whisker-reinforced mullite composites. Tiegs, T.N.; Becher, P.F.; Angelini, P. (Oak Ridge National Lab., TN (USA)). 1987. Contract AC05-84OR21400. 16p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88002611/JAW.

From 1. international workshop on mullite; Tokyo, Japan (9 Nov 1987).

Mullite is an attractive material for certain structural applications because of its excellent phase stability, low thermal conductivity, excellent creep resistance, and high temperature strength retention, as compared to other engineering ceramic materials. However, mullite suffers from low strength and fracture toughness. Results at ORNL showed significant improvement in both strength and toughness of mullite with the addition of 20 vol % SiC whiskers. The improved strength is retained up to elevated temperatures; however, at temperatures greater than 1200°C the strength is dependent on the secondary phases present at the grain boundaries. 12 refs., 7 figs., 1 tab.

9137 (CONF-871190—1) The morphology of emulsion polymerized latex particles. Wignall, G.D.; Ramakrishnan, V.R.; Linne, M.A.; Klein, A.; Sperling, L.H.; Wai, M.P.; Gelman, R.A.; Fatica, M.G.; Hoerl, R.H.; Fisher, L.W. (Oak Ridge National Lab., TN (USA); Lehigh Univ., Bethlehem, PA (USA); Hercules, Inc., Wilmington, DE (USA). Hercules Research Center; Eastman Kodak Co., Rochester, NY (USA)). Nov 1987. Contract AC05-84OR21400. 18p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88002672/JAW.

From Workshop on neutron scattering; Los Alamos, NM, USA (3 Nov 1987).

Under monomer starved feed conditions, emulsion polymerization of perdeuterated methyl methacrylate and styrene in the presence of preformed polymethylmethacrylate latexes resulted in particles with a core-shell morphology, as determined by small-angle neutron scattering (SANS) analysis for a hollow sphere. The locus of polymerization of the added deuterated monomer is therefore at the particle surface. In similar measurements a statistical copolymer of styrene and methyl methacrylate was used as seed particles for further polymerization of trideuteromethyl methacrylate. The resulting polymer latex was again shown to have a core-shell morphological structre as determined by SANS. SANS experiments were also undertaken on polystyrene latexes polymerized by equilibrium swelling methods, with deuterated polymer forming the first or second step. The experiments covered a molecular weight range of $6 \times 10^4 < M < 6 \times 10^6$ g/mol. For $M > 10^6$ the molecular weights are consistent with the experimental errors, indicating that the deuterium labeled molecules are randomly distributed in the latex. These results led to the finding that the polymer chains were constrained in the latex particles by factors of 2 to 4 from the relaxed coil dimensions. For $M < 10^6$ g/mol SANS gave zero angle scattering intensities much higher than expected on the basis of a random distribution of labeled molecules. Several models were examined, including the possible development of core-shell structures at lower molecular weights. 25 refs., 6 figs., 3 tabs.

9138 (CONF-8706151—2) Diffraction by glasses with a layer structure. Wright, A.C.; Price, D.L.; Clare, A.G.; Etherington, G.; Sinclair, R.N. (Argonne National Lab., IL (USA); Reading Univ. (UK). J.J. Thomson Physical Lab.; UKAEA Atomic Energy Research Establishment, Harwell. Materials Physics and Metallurgy Div.). Jun 1987. Contract W-31109-ENG-38. 12p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88003059/JAW.

From 2. international conference on the effects of modes of formation on the structure of glasses; Nashville, TN, USA (16 Jun 1987).

An outline is presented of the expected form of the diffraction pattern and the real space correlation function for a glass with a layer structure. The diffraction evidence for and against the presence of layers in the structure of the vitreous arsenic and germanium chalcogenides is briefly reviewed with special reference to the outrigger raft model for vitreous $GeSe_2$. 14 refs., 5 figs.

9139 (CONF-8707110—2) Nature of gigantic resistance fluctuations in metal-oxide-semiconductor wires. Kalia, R.K. (Argonne National Lab., IL (USA)). Jul 1987. Contract W-31109-ENG-38. 4p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88002905/JAW.

From 11. international workshop on condensed matter theories; Oulu, Finland (27 Jul 1987).

Recent advances in microfabrication have made it possible to create narrow electron channels in metal-oxide-semiconductor field-effect transistors (MOSFET). Using shadowing techniques, one can create gates 10 to 20 nm wide or, alternatively, one can use an electric field to pinch 2D electron gas in an accumulation layer. Resistivity measurements in these MOSFETs reveal a totally reproducible noise-like structure with varying gate voltage. The magnitude of these fluctuations grows considerably as the temperature is lowered and the temperature dependence of the resistivity is observed to be exp[A(T$_0$/T)/sup 1/2/]. We summarize the experimental observations and the current theoretical understanding of resistance fluctuations in one-dimensional metal-oxide-semiconductor field-effect transistors. 6 refs.

9140 (CONF-8708182—1) Probing medium-range order in chalcogenide glasses by neutron scattering and optical spectroscopy. Price, D.L.; Susman, S.; Wright, A.C. (Argonne National Lab., IL (USA)). Jul 1987. Contract W-31109-ENG-38. 6p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88003387/JAW.

From 12. international conference on amorphous and liquid semiconductors; Prague, Czechoslovakia (24 Aug 1987).

The use of neutron diffraction, neutron inelastic scattering, and optical spectroscopy to probe the nature of the medium-range order (MRO) in amorphous materials is discussed with reference to chalcogenides of $GeSe_2$, $SiSe_2$, and also $P_{50}Se_{50}$, and SiO_2 glasses.

While none of these probes provides a unique determination of the MRO, the use of information obtained from the three techniques, supplemented by numerical calculations based on specific structural models, can provide a picture of the essential elements of glass structure. 5 refs., 4 figs.

9141 (CSNSM-T—86-02) **Experimental study by infrared spectroscopy of irradiation effects in silicates and ices, applied to astrophysics.** Rocard, F. (Paris-11 Univ., 91 - Orsay (France). Centre de Spectrometrie Nucleaire et de Spectrometrie de Masse). May 1986. 184p. (In French). NTIS (US Sales Only), PC A09/MF A01. Order Number DE88751578/JAW.

This thesis presents the study of the radiation effects (erosion and synthesis) with ions of low energy (a few KeV/u) in silicates and ices. The erosion of the H/sub 2/O ice is analysed by infrared spectroscopy versus different parameters: ion beam flux, mass and energy of the ions, and the thickness of the samples. The interpretation is that the erosion of the ice comes mainly from the dissociation, along the ion range, of the H/sub 2/O molecules. A study of the synthesis in SiO/sub 2/ and H/sub 2/O by carbon, nitrogen and hydrogen implantation leads to the characterization of the synthesized molecules and the determination of the yields. The irradiation of ices mixtures (H/sub 2/O, CO/sub 2/ and NH/sub 3/) leads to the synthesis of a great variety of molecules which are identified. The experimental results are extrapolated to different astrophysical situations in the solar cavity (Moon, satellites of giant planets, comets) and in the interstellar medium (molecular clouds).

9142 (INIS-BR—903, pp 373-376) **On the temperature dependence of the photoconductivity of amorphous silicon nitride (a-Si Nx: H).** Tessler, L.R.; Alvarez, F.; Chambouleyron, I. (Universidade Estadual de Campinas, Brazil. Inst. de Fisica). 1984. NTIS (US Sales Only), PC A12/MF A01. Order Number DE88700663/JAW. (CONF-8402101—).

From Simposio Latino-Am. de Fis. dos sistemas amorfos; Niteroi, Brazil (1 Feb 1984).

Experimental results on the photoconducticity of amorphous hydrogenated silicon nitride a-SiNx: H prepared from plasma decomposition of a gaseus mixture of silane and nitrogen ([Si H/sub 4/]/[N/sub 2/] ~ 0.33) are presented. The material is deposited in a capacitively coupled glow discharge system and nitrogen content was continuously increased by increasing the RF power dissipated in the plasma. Studies of the photocurrent as a function of temperature as a function of temperature and light intensities are reported.

9143 (INIS-BR—903, pp 377-380) **Influence of the thermal annealing on the photoluminescence of a-Si:H:F thin films.** Mendoza A, J.G.; Torres D, G.; Gonzales H, J. (Centro de Investigacion y de Estudios Avanzados, Mexico. Dept. de Fisica; Energy Conversion Devices, Inc., Troy, MI, USA). 1984. NTIS (US Sales Only), PC A12/MF A01. Order Number DE88700663/JAW. (CONF-8402101—).

From Simposio Latino-Am. de Fis. dos sistemas amorfos; Niteroi, Brazil (1 Feb 1984).

The experimental results of the photoluminescence spectra of intrinsic layers of a: Si: H: F deposited by the electric discharge method are presented. This procedure was developed in the presence of silane. (M.W.O.).

9144 (INIS-BR—903, pp 465-467) **Adiabatic nucleation and glassy transition.** Meyer, E. (Rio de Janeiro Univ., Brazil. Inst. de Fisica). 1984. (In Portuguese). NTIS (US Sales Only), PC A12/MF A01. Order Number DE88700663/JAW. (CONF-8402101—).

From Simposio Latino-Am. de Fis. dos sistemas amorfos; Niteroi, Brazil (1 Feb 1984).

The issue of crystallization in polymers and its relation with the glassy temperature Tg and the homogeneous nucleation temperature is investigated (M.W.O.).

9145 (INIS-BR—903, pp 468-477) **Nuclear magnetic resonance and spectral diffusion in glasses.** Borges, N.M.; Engelsberg, M. (Pernambuco Univ., Recife, Brazil. Dept. de Fisica). 1984. (In Portuguese). NTIS (US Sales Only), PC A12/MF A01. Order Number DE88700663/JAW. (CONF-8402101—).

From Simposio Latino-Am. de Fis. dos sistemas amorfos; Niteroi, Brazil (1 Feb 1984).

The experimental results concerning Nuclear Magnetic Resonance in B/sub 2/O/sub 3/ glasses are presented. The data analysis allows the study of the problem of spectral diffusion in a inhomogeneously enlarged resonance line in a disordered system of nuclear spins. It is proposed a model with the aim of explaining the observed time constants and the peculiar forms of decay. (M.W.O.).

9146 (INIS-mf—11054, pp 25) **Mass-spectrometric investigations of evaporation rates of Cd and Te from the source material and epitaxial layers.** Juza, P.; Sitter, H. (Johannes Kepler Univ., Linz, Austria. Inst. fuer Experimentalphysik). Sep 1987. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88700772/JAW. (CONF-8709196—).

From Annual convention fo the Austrian Physical Society; Vienna, Austria (21 Sep 1987).

9147 (INIS-mf—11054, pp 24) **Production of CdTe volume crystals from the vapor phase.** Preininger, H.; Sitter, H. (Johannes Kepler Univ., Linz, Austria. Inst. fuer Experimentalphysik). Sep 1987. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88700772/JAW. (CONF-8709196—).

From Annual convention fo the Austrian Physical Society; Vienna, Austria (21 Sep 1987).

9148 (INIS-mf—11054, pp 18) **Fourier-synthetis of x-ray diffraction reflexes from PbTe/PbSnTe- und Si/SiGe-superlattices.** Ofner, P.; Krenn, H. (Montanuniversitaet Leoben, Austria. Inst. fuer Physik). Sep 1987. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88700772/JAW. (CONF-8709196—).

From Annual convention fo the Austrian Physical Society; Vienna, Austria (21 Sep 1987).

9149 (INIS-mf—11054, pp 28) **Positron lifetime measurements in linear and branched polyethylene.** Kindl, P.; Reiter, G. (Technische Univ., Graz, Austria. Inst. fuer Kernphysik). Sep 1987. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88700772/JAW. (CONF-8709196—).

From Annual convention fo the Austrian Physical Society; Vienna, Austria (21 Sep 1987).

9150 (INIS-mf—11054, pp 81) **Interpretation of positron-lifetime measurements in polymers at a molecular level.** Breitenhuber, L.; Kindl, P.; Reiter, G. (Technische Univ., Graz, Austria. Inst. fuer Kernphysik). Sep 1987. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88700772/JAW. (CONF-8709196—).

From Annual convention fo the Austrian Physical Society; Vienna, Austria (21 Sep 1987).

9151 (INIS-mf—11054, pp 11) **Superconductivity at high temperatures.** Bednorz, J. (IBM Research Lab., Zurich, Switzerland). Sep 1987. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88700772/JAW. (CONF-8709196—).

From Annual convention fo the Austrian Physical Society; Vienna, Austria (21 Sep 1987).

9152 (INIS-mf—11054, pp 19) **Intrinsic plateau width and the importance of sample edges on the integer quantum Hall effect.** Lim, K.Y.; Meisels, R.; Kuchar, F. (Vienna Univ., Austria. Inst. fuer Festkoerperphysik; Ludwig Boltzmann-Institut, Vienna, Austria). Sep 1987. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88700772/JAW. (CONF-8709196—).

From Annual convention fo the Austrian Physical Society; Vienna, Austria (21 Sep 1987).

9153 (INIS-mf—11054, pp 19) **Effect of hydrostatic pressure on the quantum Hall effect in GaAs/AlGaAs heterostructures.** Kalinka, G.; Meisels, R.; Kuchar, F. (Vienna Univ., Austria. Inst. fuer Festkoerperphysik; Ludwig Boltzmann-Institut, Vienna, Austria). Sep 1987. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88700772/JAW. (CONF-8709196—).

From Annual convention fo the Austrian Physical Society; Vienna, Austria (21 Sep 1987).

9154 (INIS-mf—11054, pp 20) **Characterisation of CdTe: Co by photo-EPR, photoconduction and DLTS.** Reisinger, J.; Hendorfer, G.; Brunthaler, G.; Sitter, H.; Jantsch, W. (Johannes Kepler Univ., Linz, Austria. Inst. fuer Experimentalphysik). Sep 1987. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88700772/JAW. (CONF-8709196—).

From Annual convention fo the Austrian Physical Society; Vienna, Austria (21 Sep 1987).

9155 (INIS-mf—11054, pp 24) **Atomic layer of CdTe on GaAs.** Faschinger, W.; Sitter, H. (Johannes Kepler Univ., Linz, Austria. Inst. fuer Experimentalphysik). Sep 1987. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88700772/JAW. (CONF-8709196—).

From Annual convention fo the Austrian Physical Society; Vienna, Austria (21 Sep 1987).

9156 (INIS-mf—11054, pp 28) **Positron states in polymers.** Reiter, G.; Kindl, P. (Technische Univ., Graz, Austria. Inst. fuer Kernphysik). Sep 1987. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88700772/JAW. (CONF-8709196—).

From Annual convention fo the Austrian Physical Society; Vienna, Austria (21 Sep 1987).

9157 (INIS-mf—11054, pp 29) **Positron investigations on differently doped Cz-Si samples.** Puff, W.; Mascher, P. (Technische Univ., Graz, Austria. Inst. fuer Kernphysik; Univ. of Winnipeg, Winnipeg, Canada). Sep 1987. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88700772/JAW. (CONF-8709196—).

From Annual convention fo the Austrian Physical Society; Vienna, Austria (21 Sep 1987).

9158 (INIS-mf—11054, pp 45) **On /sup h/eavy-fermion/sup -/behavior of cerium compounds.** Bauer, E.; Gratz, E.; Pillmayr, N.; Gignoux, D.; Schmitt, D.; Winzer, K. (Technische Univ., Vienna, Austria. Inst. fuer Experimentalphysik; Laboratoire Louis Neel,CNRS Grenoble, France; Goettingen Univ., Germany, F.R. 1. Physikalisches Inst.). Sep 1987. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88700772/JAW. (CONF-8709196—).

From Annual convention fo the Austrian Physical Society; Vienna, Austria (21 Sep 1987).

9159 (LA—10686-MS) **Processing, fabrication, applications, and limitations of inherently conducting polymers.** Aldissi, M. (Los Alamos National Lab., NM (USA)). Nov 1987. Contract W-7405-ENG-36. 95p. NTIS, PC A05/MF A01; 1; GPO Dep. Order Number DE88003210/JAW.

Electrically conducting polymers have many potential applications and thus are a focus of research interest. Such polymers depend on a conjugated backbone that can be doped with highly reactive materials to increase conductivity, but this backbone is also the source of instability in these materials. The work described in this report concentrates on solving these instability problems, using various doping techniques to yield polymers more stable than polyacetylene, (CH)/sub x/, the first extensively characterized covalent organic polymer. We describe several methods of synthesizing conjugated polymers and discuss ways of doping the conjugated backbone. The stability of pristine and doped polymers is examined in ambient atmosphere and under thermal treatment, and several stabilization techniques are discussed, including chemical doping, ion implantation, plastification, copolymerization, antioxidative treatments, surface protection, and the use of crown ethers. Although progress has been made, a fully stable, highly conductive polymer still awaits development. Various possible uses of such a polymer and the conditions for successful applications are described, as are the relative advantages and disadvantages of currently available polymers. 144 refs., 76 figs., 12 tabs.

9160 (LBL—22075, pp 15-31) **Electronic materials.** Apr 1987. NTIS, PC A06/MF A01. Order Number DE88000686/JAW.

In Center for Advanced Materials: Annual report, 1986.

The Electronic Materials Program (EMP) focuses on solving major scientific problems impeding the development of large-scale digital integrated circuits and optoelectronic devices based on gallium arsenide (GaAs). The interdisciplinary basic research effort will elucidate the mechanisms of structural defect formation (e.g. dislocations, point defects, etc.) and impurity distribution during bulk crystal growth, the relationship between the structure and electronic properties of interfaces and the effect of substrate defects on the quality of epitaxial thin films and direct implantation devices. Major recent accomplishments of the program include: Reproducible growth of 2" diameter single crystals with low dislocation densities. Development of a model of As-rich precipitate formation based on extensive electron microscopy studies of pure and doped GaAs. Comprehensive studies of the effects of solid phase reactions on the electrical properties of thermally annealed metal-GaAs contacts. 56 refs., 8 figs.

9161 (LBL—22075, pp 65-80) **Instrumentation for surface science.** Apr 1987. NTIS, PC A06/MF A01. Order Number DE88000686/JAW.

In Center for Advanced Materials: Annual report, 1986.

The Instrumentation for Surface Science Program is concerned with the development of new techniques and instruments for the study of surfaces. It has three experimental components: Applications of the scanning tunneling microscope (STM); investigation of surfaces by nonlinear optical techniques; and studies of surface with infrared techniques. New tools developed include: The STM, a major new tool for surface science that is unique for the study of both the topology and electronic properties of surfaces; A new surface analytical tool using surface optical second harmonic generation to study organic monolayers on a liquid surface; and, a new type of calorimeter to determine the heat capacity of thin layers of CO adsorbed on evaporated silver films. 71 refs., 8 figs.

9162 (LBL—22075, pp 81-100) **Polymers and composites.** Apr 1987. NTIS, PC A06/MF A01. Order Number DE88000686/JAW.

In Center for Advanced Materials: Annual report, 1986.

High performance polymeric materials are now being used in large-scale and load-bearing applications which in the past have demanded the use of metals. Understanding the development of high strength and rigidity in polymeric materials requires some molecular concepts which are not found in other branches of materials science. The long, essentially linear molecules of thermoplastic polymers can be extended or coiled. The degree to which the chains are extended, and the degree to which they are oriented in a single direction, extended or not, control the physical properties of the polymer. This microstructure is determined to a large extent by how processing and shaping are carried out in the liquid state; liquid state shaping usually involves subtle interactions between cooling rates and deformation history and the control of phase changes. The primary emphasis of this research has been on two problems: the development of computational tools for the prediction of structure development in complex shaping flows, and the analysis of structure development in anisotropic (usually heterogeneous) materials. These anisotropic materials, which include liquid crystal polymers and multiphasic polymeric systems, encompass the major areas of opportunity for significant advances in high-performance polymers. 65 refs., 10 figs.

9163 **(LBL—24120) Fluid mechanical issues in polymer processing.** Denn, M.M. (Lawrence Berkeley Lab., CA (USA)). Oct 1987. Contract AC03-76SF00098. 6p. (CONF-871233—1). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88002767/JAW.

From Symposium on interdisciplinary issues in materials processing and manufacturing; Boston, MA, USA (13 Dec 1987).

Microstructure in polymers is developed during shaping operations which are carried out in the fluid state. Propagation of the large streases caused by singularities associated with the flow of viscoelastic liquids near corners and lips is a limiting factor in the numerical solution of processing flows; the strength of the singularity is unknown. There is considerable evidence to indicate that the no-slip boundary condition is inappropriate in polymer processing flows, but the proper replacement has not been established. Other significant issues include flow instabilities and the analysis of the flow of anisotropic liquids. 21 refs.

9164 **(N—87-28880) Bonding lexan and sapphire to form high-pressure, flame-resistance window.** Richardson, W.R.; Walker, E.D. (National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center). 1987. 8p. (NASA-TM—100188; E—3769; NAS—1.15:100188; CONF-8710222—). NTIS, PC A02/MF A01.

From 129. technical conference and equipment exhibit; Los Angeles, CA, USA (31 Oct 1987).

Flammable materials have been studied in normal gravity and microgravity for many years. Photography plays a major role in the study of the combustion process giving a permanent visual record that can be analyzed. When these studies are extended to manned spacecraft, safety becomes a primary concern. The need for a high-pressure, flame-resistant, shatter-resistant window permitting photographic recording of combustion experiments in manned spacecraft prompted the development of a method for bonding Lexan and sapphire. Materials that resist shattering (e.g., Lexan) are not compatible with combustion experiments; the material loses strength at combustion temperatures. Sapphire is compatible with combustion temperatures in oxygen-enriched atmospheres but is subject to shattering. Combining the two materials results in a shatter-resistant, flame-resistant window. Combustion in microgravity produces a low-visibility flame; however, flame propagation and flame characteristics are readily visible as long as there is no deterioration of the image. Since an air gap between the Lexan and the sapphire would reduce transmission, a method was developed for bonding these unlike materials to minimize light loss.

9165 **(ND-R—1057(S)) Pore structure model for the gas transport property changes, initial oxidation rates and cumulative weight loss of AGR moderator graphite.** Johnson, P.A.V. (UKAEA Risley Nuclear Power Development Establishment). Sep 1985. 31p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88750685/JAW.

A quantitative model has been developed for the gas transport property variation, cumulative weight loss and initial oxidation rates of AGR moderator graphite. The model utilises the theory of dynamic moments of the pore structure to calculate the changes in physical properties brought about by radiolytic corrosion taking place within the graphite porosity. In order to account for the behaviour of the initial rate curves, and the weight loss data obtained it is necessary to invoke the presence of a group of cylindrical pore and a group of small slab-shaped pores. The latter are methane depleted. This is in addition to the pore group involved in gas transport which is best represented by cylinders of mean radius 2.13 μm. The model satisfactorily predicts the experimental weight loss data obtained from experiments in the DIDO 6V3 and BFB loops.

9166 **(NUREG/CR—4530/2) US/French joint research program regarding the behavior of polymer base materials subjected to beta radiation: Volume 2, Phase-2a screening tests: [Final report].** Buckalew, W.H.; Wyant, F.J.; Chenion, J.; Carlin, F.; Gaussens, G.; Le Tutour, P.; Le Meur, M. (Sandia National Labs., Albuquerque, NM (USA)). Sep 1987. Contract AC04-76DP00789. 61p. (SAND—86-0366; IPSN—1/87). NTIS, PC A04/MF A01 - GPO. Order Number TI88002608/JAW.

As part of the ongoing joint NRC/CEA cooperative test program to investigate the relative effectiveness of beta and gamma irradiation to produce damage in polymer base materials, ethylene propylene rubber (EPR) specimens, in slab geometry, were exposed to Cobalt-60 gamma rays and accelerator produced electron beams. Specimens were irradiated and evaluated at research facilities in the US (Sandia National Laboratories) and France (Compagnie ORIS Industrie). These tests included several electron beam energies, sample thicknesses, exposure doses, and dose rates. Based on changes in the tensile properties, of the test specimens, results of these studies suggest that material damage resulting from electron and gamma irradiations can be correlated on the basis of absorbed radiation dose.

9167 **(SAND—87-1434C) Interaction of deuterium with buried oxides in silicon.** Myers, S.M. (Sandia National Labs., Albuquerque, NM (USA)). 1987. Contract AC04-76DP00789. 6p. (CONF-871124—9). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88002719/JAW.

From Fall meeting of the Materials Research Society; Boston, MA, USA (30 Nov 1987).

Silicon with buried oxides formed by ion implantation (SIMOX) or zone-melt recrystallization (ZMR) was exposed to deuterium gas at temperatures from 773 to 1273°K, and the depth profile of the D was then determined by nuclear-reaction analysis. The D was distributed through the buried oxide, with no measurable quantity in the Si phase. Uptake was controlled by permeation through the Si overlayer, and the permeability of D in Si was determined at 873°K. The sample dependence of D uptake indicated substantially fewer defect-trap sites in SIMOX oxide annealed at 1678°K as opposed to 1548°K, with still smaller defect densities in the ZMR oxide. Hydrogen exposure at 1273°K substantially disrupted the SIMOX structures. 6 refs., 5 figs., 1 tab.

9168 **(SAND—87-1489C) Control of solid-excitation-based photochemical dry etching of semiconductors by ion-bombardment-induced damage.** Ashby, C.I.H.; Myers, D.R. (Sandia National Labs., Albuquerque, NM (USA)). 1987. Contract AC04-76DP00789. 6p. (CONF-871124—12). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88003214/JAW.

From Fall meeting of the Materials Research Society; Boston, MA, USA (30 Nov 1987).

Carrier-driven photochemical dry etching of semiconductors can be selectively suppressed by ion-implantation-induced defects. The magnitude of this suppression depends on the semiconductor impurity doping concentration, the ion fluence, and the photo-excitation wavelength. 12 refs., 4 figs.

9169 **(SAND—87-1524C) Formation and passivation of new paramagnetic defects associated with thermal oxides on silicon.** Brower, K.L. (Sandia National Labs., Albuquerque, NM (USA)). 1987. Contract AC04-76DP00789. 4p. (CONF-871124—8). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88002720/JAW.

From Fall meeting of the Materials Research Society; Boston, MA, USA (30 Nov 1987).

A new spin resonance spectrum has been observed with electron paramagnetic resonance in thermal oxides grown on (111) silicon. Our analysis indicates that this new spectrum consists of two isotropic resonances. One resonance has a g-value of 2.0026 and a linewidth (FWHM) of 1.2 G (labeled SL8); the other resonance has a g-value of 2.0029 and a linewidth (FWHM) of 5 G (labeled SL9). The SL8 resonance appears to be associated with the as-grown thermal oxide. The effects of ^{60}Co gamma irradiation and annealing in either hydrogen or ammonia on these spectra are also presented. 12 refs., 2 figs.

9170 **(SAND—87-2372) In situ growth and structure of fractal silica aggregates in a flame.** Hurd, A.J.; Flower, W.L. (Sandia National Labs., Albuquerque, NM (USA); Sandia National Labs., Livermore, CA (USA)). Oct 1987. Contract AC04-76DP00789. 44p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88003241/JAW.

We studied flame-generated (fumed) silica particles in situ by static and dynamic light scattering and ex situ by transmission electron microscopy. The growth and aggregation of the particles was followed as a function of height in the flame. The scattered intensi-

ty appeared to be consistent with a fractal aggregate structure having a fractal dimension of D = 1.49 (smaller than previously reported ex situ measurements of fumed silica) although the data are too limited to determine D with certainty. From the dynamic light scattering results, corrected for polydispersity, the growth trend appeared to deviate from free-molecular behavior for long residence times. From the electron microscopy, we noted a surprising tendency for the silica monomers to shrink with residence time. 32 refs., 1 fig., 2 tabs.

9171 **(UCRL—15961) Impurity Studies, Phase 2: Final status report.** Krashkevich, D.; Marker, A. III. (Schott Glass Technologies, Inc., Duryea, PA (USA)). [1988]. Contract W-7405-ENG-48. 135p. NTIS, PC A07/MF A01; 1; GPO Dep. Order Number DE88002447/JAW.

The Sixth Status Report comprises experimental results which expand on the quenching effect of iron in the UP-91 glass matrix doped with 5.0 x 12^{20} neodymium ions per cm^3. The effect of iron on quenching as a function of neodymium content in UP-91 is also investigated. The dopant level of iron for this study is chosen to be 300 ppMw Fe. Plots of the 1st e-folding time, ln 1st e-folding time and decay rate as a function of iron impurity input at a fixed Nd concentration and Nd concentration at a fixed Fe input are included. Also plotted on all graphs is the OH absorption coefficient at 3.5 μm for each melt which monitors OH contamination level. 32 tabs.

9172 **(UCRL—96205) Failure modes of laminate structures.** Gordon, L.B.; Druce, R.L.; Wilson, M.J. (Lawrence Livermore National Lab., CA (USA); Auburn Univ., AL (USA). Space Power Inst.). Jun 1987. Contract W-7405-ENG-48. 6p. (CONF-870656—48). NTIS, PC A02. Order Number DE88002579/JAW.

From 6. Institute of Electrical and Electronic Engineers pulsed power conference; Arlington, VA, USA (29 Jun 1987).

Laminate structures composed of alternating thin layers of conductor and dielectric material are commonly used in energy storage and transmission components. The failure of the dielectric layers in regions of high field stress, with applied 60 Hz ac, dc and impulse voltages, was studied. Several geometries were compared, including staggered and flush edges. Electrical trees developed between the laminated dielectric layers. The visual characteristics and growth rates of the electrical trees under ac, dc and impulse stresses were different. Partial discharge detection and analysis was used to measure the inception voltage and discharge activity at the conductor edge voids; to observe tree formation and growth, and to predict impending failure due to dielectric erosion. Electric field distributions were modeled and partial discharge inception levels were estimated from known void geometries. The staggered edge geometry appears to enhance the electric field stress at the recessed electrode.

9173 **Laser-based secondary neutral mass spectroscopy: Useful yield and sensitivity.** Young, C.E.; Pellin, M.J.; Calaway, W.F.; Jorgensen, B.; Schweitzer, E.L.; Gruen, D.M. (Materials Science and Chemistry Divisions, Argonne National Lab., Argonne, IL 60439). pp 119-129 of Particle and photon interactions with surfaces. Gruen, D.M.; Krauss, A.R.; Pellin, M.J.; Young, C.E. New York, NY; Elsevier Science Pub. Co. Inc. (1987). (CONF-860807—). Contract W-31-109-ENG-38.

From 6. international workshop on inelastic ion surface collisions; Argonne, IL, USA (25 Aug 1986).

Multiphoton ionization (MPI) by pulsed, tunable lasers provides a sensitive means for detection of neutral atoms due to the high efficiency achievable both in the ionization and subsequent detection. Substantial selectivity can be achieved by excitation between energy levels of the atom of interest. This resonant MPI technique can access all atomic states of any particular atom including its ground and metastable levels. In practice resonance ionization has been experimentally demonstrated for nearly every element. A variety of problems exist in order to optimally apply resonance ionization spectroscopy (RIS) to the detection of sputtered neutral atoms, however. Several of these problems and their solutions are examined in this paper. That it is possible to combine in one instrument both high useful yields and high sensitivity for the detection of minority species is be demonstrated with results of Fe implanted Si samples in the surface analysis by resonance ionization of sputtered atoms (SARISA) instrument. SARISA accomplishes the necessary noise reduction without signal loss through the extraction of the photoions into a sector-field time-of-flight (TOF) mass spectrometer.

9174 **Mobility of implanted hydrogen and carbon in magnesium oxide single crystals.** Knipping, U.; Tsong, I.S.T.; Arnold, G.W. (Arizona State Univ., Tempe, USA. Dept. of Physics; Sandia National Labs., Albuquerque, NM, USA). *Radiation Effects;* 97: No. 3-4, 209-214(Sep 1986). (CONF-8507164—). Contract AC04-76DP00789.

From 3. international conference on radiation effects in insulators; Guildford, UK (15 Jul 1985).

MgO single crystals were implanted with 40 keV H_3^+ and 60 keV C^+ ions. The diffusion behavior of the implant species in the temperature range 25-500°C was studied by SIMS depth-profiling. The $^1H^+$ and $^{13}C^-$ SIMS profiles show practically no movement of implanted species. The results suggest that both hydrogen and carbon are tightly bound in the MgO.

9175 **Annealing studies of alpha-Al_2O_3 implanted with bromine.** Farlow, G.C.; McHargue, C.J.; White, C.W.; Appleton, B.R. (Oak Ridge National Lab., TN, USA). *Radiation Effects;* 97: No. 3-4, 257-264(Sep 1986). (CONF-8507164—). Contract AC05-84OR21400.

From 3. international conference on radiation effects in insulators; Guildford, UK (15 Jul 1985).

Aluminum oxide was implanted with bromine and subsequently annealed at temperatures between 800 and 1500°C in a reducing atmosphere. Changes in the lattice damage and the impurity distribution were monitored by Rutherford back-scattering and channeling techniques. Changes in the topography were monitored by optical and secondary electron microscopy. The implantation resulted in the formation of an 'amorphous' surface layer. Upon annealing, the bromine segregated to form bubbles which blistered releasing 90% of the bromine from the Al_2O_3 matrix.

9176 **Determination of steady state creep rates and activation parameters for rock salt.** Wawersik, W.R. (Geomechanics Div. 1542, Sandia National Labs., Albuquerque, NM 87185). pp 72-92 of Measurement of rock properties at elevated pressures and temperatures. Pincus, H.J.; Hoskins, E.R. Philadelphia, PA; ASTM (1985). (CONF-830605—). Contract AC04-76DP00789.

From 24. symposium on rock mechanics; College Station, TX, USA (20 Jun 1983).

Measurements of steady state creep rates and activation parameters are described for rock salt at low temperature (T ≦ 0.4T/sub m/; where T/sub m/ is melting temperature) and low strain rates. The determinations of steady state creep rates rely on the evaluation of upper and lower bounds associated with characteristic transients after changes in stress and temperature. First order activation analyses make use of correlations between the steady state creep rates, stress, and temperature. More rigorous activation analyses result from comparisons of creep rates right before and after temperature and stress changes. Selected experimental results are given for rock salts from two locales deformed between 40 and 160°C. Based on measured values of activation enthalpies, activation areas, correlations between steady state creep rates by means of a power law, and some temperature-induced transients, it is suggested that the low-temperature creep of rock salt is affected by large, independent contributions from glide mechanisms besides dislocation climb.

40 CHEMISTRY

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9177 (AERE-R—12009) Assessment of the assay of the actinide content of 500 litre drums of intermediate level waste using photofission. Findlay, D.J.S. (UKAEA Atomic Energy Research Establishment, Harwell. Nuclear Physics Div.). Apr 1986. 29p. (ILWRP—85-P19). H.M. Stationery Office, London, price Pound 4.00.

An initial assessment is made of the feasibility of assaying the actinide content of 500 litre drums of cemented intermediate level waste using photofission. Bremsstrahlung from a approx.7 MeV radiography linac is considered to be the source of photons, and photofission neutrons and photoneutrons from the actinide isotopes are considered to be detected in $^{10}BF_3$ counters around the drum. The conclusion, based on counting statistics alone, is that the actinide content of a drum (nearly all ^{238}U) could be assayed to +- approx.40 g.

9178 (AERE-R—12074) Differential dieaway technique applied to the measurement of the fissile content of drums of cement encapsulated waste. A Monte Carlo study. Swinhoe, M.T. (UKAEA Atomic Energy Research Establishment, Harwell. Nuclear Physics Div.). Jan 1986. 34p. (ILWRP—85-P17). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88750683/JAW.

This report describes calculations of the differential dieaway technique as applied to cement encapsulated waste. The main difference from previous applications of the technique are that only one detector position is used (diametrically opposite the neutron source) and the chamber walls are made of concrete. The results show that by rotating the drum the response to fissile material across the central plane of the drum can be made relatively uniform. The absolute size of the response is about 0.4. counts per minute per gram fissile for a neutron source of 10^8 neutrons per second. Problems of neutron and gamma background and water content are considered.

9179 (BDX—613-3798) Ion chromatography in the manufacture of multilayer circuit boards. Smith, R.E. (Allied Corp., Kansas City, MO (USA). Bendix Kansas City Div.). Oct 1987. Contract AC04-76DP00613. 11p. (CONF-8709185—1). NTIS, PC A02/MF A01; GPO Dep. Order Number DE88002428/JAW.

From Ion chromatography symposium in the aerospace and semiconductor industries; Anaheim, CA, USA (23 Sep 1987).

Ion chromatography (IC) has proven useful in analyzing chemical solutions used in the manufacture of multilayer circuit boards. IC provides results on ions not expected in the production solutions. Thus solution contamination, and breakdown products can be monitored in every phase of the circuit board manufacturing. During the first phase, epoxy laminates experience an etchback, first in chromic acid, which can be analyzed for trace chloride and sulfate, then in ammonium bifluoride/HCl, which can be analyzed for fluoride and chloride. Following a wet blasting to roughen up the surface, 20 μin. of copper are deposited using an electroless bath. Again, IC is applicable for monitoring formate, tartarate, and sulfate levels. Next, an acid copper bath is used to electroplate the through holes with 0.001 in. of ductile copper. This bath is analyzed for trace chloride. Photoimaging is then performed, and the organic solvents used can be assayed for trace ionic chloride. Finally, a fluoroboric acid-based tin-lead bath is used to deposit a solderable alloy. This bath is analyzed for total fluoroborate, tin, and lead. In addition, mobile phase ion chromatography (MPIC) is used to monitor the nonionic organic brighteners in the baths. 11 refs., 3 figs.

9180 (CEGB-TPRD/B—0731/N85) On-line actinide-in-air monitor to operate at concentrations below 0.1 ICRP MPCsub(a). Woollam, P.B. (Central Electricity Generating Board, Berkeley (UK). Berkeley Nuclear Labs.). Nov 1985. 41p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88750718/JAW.

A prototype on-line actinide-in-air monitoring system has been built which has sufficient sensitivity to determine average concentrations as low as 0.04 dpm m^{-3} (8 x 10^{-3} ICRP MPCsub(a)) over an 8 h shift. Routine measurements at 0.3 dmp m^{-3} (0.075 ICRP MPCsub(a)) can be made with a probability of < 1% per shift of a false alarm, even in the presence of unusually large concentrations of radon daughter products. The system uses a combination of inertial particle size separation, alpha energy discrimination and isotope decay analysis to achieve this performance, which is between 10 and 100 times better than commercially available equipment. (U.K.).

9181 (CONF-8711109—1) Development of the NBS beryllium isotopic standard reference material. Inn, K.G.W; Fassett, J.D.; Coursey, B.M.; Walker, R.L.; Raman, S. (National Bureau of Standards, Washington, DC (USA); Oak Ridge National Lab., TN (USA)). 1987. Contract AC05-84OR21400. 5p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88002671/JAW.

From Workshop on advanced laser technology for chemical measurements; Gaithersburg, MD, USA (4 Nov 1987).

The National Bureau of Standards, in conjunction with the Oak Ridge National Laboratory and the Accelerator Mass Spectrometry community, is in the process of developing a beryllium isotopic solution Standard Reference Material. The master $^{10}Be/^{9}Be$ solution was characterized isotopically by resonance-ionization and secondary-ion mass-spectrometric-based techniques, and radioactivity measurements were by liquid scintillation counting. The master solution was gravimetrically diluted with ^{9}Be to a final $^{10}Be/^{9}Be$ atomic ratio of 3 x 10^{-11}. The preliminary data indicate a half life for ^{10}Be of 1.3 million years, and AMS measurements are within 10% of the known beryllium isotopic ratio.

9182 (DOE/ER/13589—1) [The use of ion chromatography-dc plasma atomic emission spectrometry for the speciation of trace metals]: Progress report. Urasa, I.T. (Hampton Univ., VA (USA). Dept. of Chemistry). 28 Sep 1987. Contract FG05-86ER13589. 22p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88002128/JAW.

Purpose of this research is to study the interfacing of ion chromatography (IC) with dc plasma atomic emission spectrometry (DCPAES), tailoring the combined system to trace metal speciation in aqueous solutions. The DCPAES will serve as an element selective method of detection (ESD) for ion chromatographic effluents. Arsenic, chromium, iron, manganese, nickel, and vanadium were used as examples in the study. The work focused on: (1) evaluation of the factors that influence coupling of IC with DCPAES; (2) evaluation of influential chromatographic parameter such as type of column, eluent composition and element flow rate; (3) evaluation of sample matrix effects; and (4) development of procedures that can be employed to enhance measurement sensitivity. The methods will be applied in the analysis of selected environmental samples and energy related materials such as fossil fuels.

9183 (FMPC—2073) Surface decontamination of uranium metal samples for conversion to triuranium octoxide: Topical report. Carnes, M.B. (Westinghouse Materials Co. of Ohio, Cincinnati (USA). Feed Materials Production Center). Oct 1987. Contract AC05-86OR21600. 17p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88002825/JAW.

Uranium metal samples for optical emission analysis at the Feed Materials Production Center (FMPC) traditionally were cleaned by sequentially using nitric acid, distilled water and acetone. The metallic samples were then dried using compressed air. Alternate procedures eliminating environmentally undesirable nitrates were investigated. This study shows that uranium metal can be cleaned successfully in acetone via sonication. Nitric acid is needed to clean platinum conversion equipment. 3 refs., 8 tabs.

9184 (GKSS—87/E/23) **Process modelling of gas permeation plants.** Hattenbach, K. (GKSS-Forschungszentrum Geesthacht G.m.b.H., Geesthacht-Tesperhude (Germany, F.R.)). 1987. 23p. (In German). (CONF-8702116—1). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88750530/JAW.

From Seminar on industrial application of the novel membrane techniques of gas permeation and pervaporation; Wuppertal, F.R. Germany (24 Feb 1987).

A review about the different models of gas permeation is given together with the mathematical handling. A new work diagram for cross flow permeation is evaluated. At last an example of a two-stage process is discussed. With 8 figs..

9185 (INIS-SU—429, pp 62) **On possibility of systematic extraction-photometric analysis of lanthanide mixture.** Per'kov, I.G. (Khar'kovskij Gosudarstvennyj Univ., Ukrainian SSR). 1985. (In Russian). NTIS (US Sales Only), PC A12/MF A01. Order Number DE88780030/JAW. (CONF-8510473—).

From 2. republic conference on analytical chemistry; Uzhgorod, Ukrainian SSR (1 Oct 1985).

9186 (INIS-SU—429, pp 173) **Atomic absorption analysis of some metallurgical products with the use of electrothermic atomizer in air oxidative atmosphere.** Borisyuk, N.A.; Gitina, M.M.; Shcherbakova, T.M.; Zakhariya, A.N.; Mukhovina, G.O. (Odesskij Gosudarstvennyj Univ., Ukrainian SSR). 1985. (In Russian). NTIS (US Sales Only), PC A12/MF A01. Order Number DE88780030/JAW. (CONF-8510473—).

From 2. republic conference on analytical chemistry; Uzhgorod, Ukrainian SSR (1 Oct 1985).

9187 (INIS-SU—429, pp 188-189) **Study of atomization mechanism of extracts and their application in electrothermic atomic absorption analysis.** Pilipenko, A.T.; Samchuk, A.I. 1985. (In Russian). NTIS (US Sales Only), PC A12/MF A01. Order Number DE88780030/JAW. (CONF-8510473—).

From 2. republic conference on analytical chemistry; Uzhgorod, Ukrainian SSR (1 Oct 1985).

9188 (INIS-SU—429, pp 197-198) **Standardless X-ray fluorescence determination of activating additions in monocrystals.** Shevtsov, N.I.; Mirenskaya, I.I.; Afanasiadi, L.I. (Vsesoyuznyj Nauchno-Issledovatel'skij Inst. Monokristallov, Stsintilyatsionnykh Materialov i Osobo Chistykh Veshestv, Kharkov, Ukrainian SSR). 1985. (In Russian). NTIS (US Sales Only), PC A12/MF A01. Order Number DE88780030/JAW. (CONF-8510473—).

From 2. republic conference on analytical chemistry; Uzhgorod, Ukrainian SSR (1 Oct 1985).

9189 (INIS-SU—429, pp 71) **Iron and molybdenum extraction from solutions of trichloroacetic acid and sodium trichloroacetate.** Uvarova, K.A.; Godyna, N.F.; Kozlova, I.A. (Donetskij Politekhnicheskij Inst., Ukrainian SSR). 1985. (In Russian). NTIS (US Sales Only), PC A12/MF A01. Order Number DE88780030/JAW. (CONF-8510473—).

From 2. republic conference on analytical chemistry; Uzhgorod, Ukrainian SSR (1 Oct 1985).

9190 (INIS-SU—429, pp 115) **Electrochemical reduction of ytterbium ions on mercury-dropping electrode.** Levitskaya, G.D.; Ture, M.F.; Lata, L.P.; Dubas, L.Z. (L'vovskij Gosudarstvennyj Univ., Ukrainian SSR). 1985. (In Russian). NTIS (US Sales Only), PC A12/MF A01. Order Number DE88780030/JAW. (CONF-8510473—).

From 2. republic conference on analytical chemistry; Uzhgorod, Ukrainian SSR (1 Oct 1985).

9191 (JINR—12-86-737) **New possibilities of chemical concentration in activation analysis of some noble and rare metals.** Zhujkov, B.L.; Popeko, G.S.; Ortega, Kh.D. (Joint Inst. for Nuclear Research, Dubna, USSR. Lab. of Nuclear Reactions). (Joint Inst. for Nuclear Research, Dubna (USSR)). 1986. 7p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88700898/JAW.

Submitted to the journal J. Radioanal. Nucl. Chem. .

The possibility of concentrating Pt, Ir, Au, Ag, Re and some other elements from samples of chromites, sulfide ores, laterites, shales, titanium magnetites, and ultrabasic rocks was studied. A new simple procedure is based on sublimation of elements to be determined in air stream at 1200 deg C in the presence of some powdered reagents (e.g., TiO/sub 2/, Nb/sub 2/O/sub 5/, Nb) to enhance the yield, and on the use of chemical filters (CaO, MgO, TiO/sub 2/, Al/sub 2/O/sub 3/, Nb/sub 2/O/sub 5/) absorbing the interfering volatile elements from the gas phase. Methods of neutron activation and X-ray fluorescence isotopic excitation were used to analyze the obtained concentrates. 4 refs.; 5 figs; 3 tabs.

9192 (JINR—12-86-787) **Selektive extraction of transplutonium and rare earth elements by trioctylphosphine oxide.** Gorski, B.; Korotkin, Yu.S.; Kosyakov, V.N. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Reactions). 1986. 7p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88700899/JAW.

Submitted to the journal J. Radioanal. Nucl. Chem. .

In the studies of nuclear reactions of heavy ions with heavy nuclei it is often necessary to determine the yields of TPE. Trioctylphosphine oxide (TOPO) has a high selectivity towards trivalent TPE and rare earths. The possibility to use target of catcher metals as salting-out agents in the extraction of TPE with TOPO from solutions containing DTPA and lactic acid was studied. The influence of the concentration of Pb, Bi, Cu, Ni, nitric acid and TOPO on the distribution coefficients was determined. The advantage of application of the method for the extraction chromatographic separation of TPE and rare earths from other elements produced in the interaction of ions with heavy elements are shown. 6 refs.; 3 figs.; 5 tabs.

9193 (LA-UR—87-3678) **Prototype fast neutron counter for the assay of impure plutonium.** Wachter, J.R.; Adams, E.L.; Ensslin, N. (Los Alamos National Lab., NM (USA)). 1987. Contract W-7405-ENG-36. 7p. (CONF-871110—8). NTIS, PC A02. Order Number DE88003181/JAW.

From 3. international conference on facility operations safeguards interface; San Diego, CA, USA (29 Nov 1987).

A fast coincident neutron counter using liquid scintillators and gamma-ray/neutron pulse-shape discrimination has been constructed for the analysis of plutonium samples with unknown self-multiplication and (α,n) production. The counter was used to measure plutonium-bearing materials that cover a range of masses and (α,n) reaction rates of importance to the safeguards community. Measured values of the ^{240}Pu effective mass differed, on average, from their declared values by 0.4% for plutonium oxides and by -2.2% for metal and MgO-loaded samples. Poorer results were obtained for materials with large (α,n) reaction rates and low self-multiplication such as plutonium ash and plutonium fluoride.

9194 (NIIAR—33(679)) **Identification of oxygen-containing groups in oxidation products of ditolylmethane.** Tebelev, L.G.; Sokolov, E.I.; Nevaeva, V.E.; Voznesenskaya, S.V.; Lebedevskaya, V.G.; Varlashova, L.N.; Sudnik, M.V. (Nauchno-Issledovatel'skij Inst. Atomnykh Reaktorov, Dimitrovgrad (USSR)). 1985. 22p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88700937/JAW.

Some oxygen-contained impurities have been detected in both the AST-1 Atomic Power Station ditolylmethane coolant and deposits using infrared spectroscopy, polarography and potentiometry. Adsorption methods for their separation from the coolant are described. It has been shown that the ditolylmethane oxidation products contain the oxygen-group compounds (aromatic alkohols and phenols), aromatic acids, aldehydes, ketones and ethers. 24 refs.; 9 figs.; 2 tabs.

9195 **Rapid determination of thorium-230 in mill tailings by α spectrometry.** Donivan, S.; Hollenbach, M.; Costello, M. (UNC Geotech, Grand Junction, CO). *Analytical Chemistry;* **59**: No. 21, 2556-2558(1 Nov 1987). Contract AC07-86ID12584.

A rapid procedure for the determination of ^{230}Th in mill tailings by α spectrometry following lithium metaborate fusion and purification by solvent extraction has been developed. The source for α spectrometry is prepared by coprecipitation with cerium fluoride. The procedure has been applied to samples collected at Department of Energy remedial action sites, demonstrating an accuracy of 2.5% and a precision of 5%. The detection limit of 0.3 pCi/g. With this procedure, a single analyst can analyze 15 samples/day.

9196 **Feasibility studies for the detection of organic surface and subsurface water contaminants by surface-enhanced Raman spectroscopy on silver electrodes.** Carrabba, M.M.; Edmonds, R.B.; Rauh, R.D. (EIC Labs., Inc., Norwood, MA). *Analytical Chemistry;* **59**: No. 21, 2559-2563(1 Nov 1987). Contract AC01-86ER80333.

Fundamental components of various families of organic contaminants that are found in surface and subsurface waters have been investigated by surface-enhanced Raman spectroscopy (SERS). The SERS substrate was a silver electrode maintained at various electrode potentials. The limit of detection for pyridine was calculated to be 8.5 pg. Variation of the electrode potential and excitation wavelength was used to qualitatively determine a two-component mixture of contaminants. The in situ type of conditions of low ionic strengths and humic materials was found not to inhibit the SERS effect on the silver electrode.

9197 **Nonaqueous sedimentation field flow fractionation.** Yonker, C.R.; Jones, H.K.; Robertson, D.M. (Pacific Northwest Lab., Richland, WA). *Analytical Chemistry;* **59**: No. 21. 2574-2579(1 Nov 1987). Contract AC06-76RL01830.

The characterization of inorganic submicrometer size particles by sedimentation field flow fractionation (SdFFF) with organic instead of aqueous liquids is described. The difference between particle and liquid densities can be varied with different organic liquids and thus is advantageous in controlling retention times needed to effect the separation as compared with aqueous systems. The retention of inorganic silica particles is compared in both aqueous and nonaqueous systems.

9198 **Pulsed-ultraviolet laser Raman diagnostics of low-pressure plasma processing discharges.** Greenberg, K.E.; Hargis, P.J. Jr. (Sandia National Labs., Albuquerque, NM 87185-5800). pp 214 of Proceedings of the conference on lasers and electro-optics. Piscataway, NJ; IEEE Service Center (1987). (CONF-870401—).

From OSA/IEEE conference on lasers and electro-optics (CLEO '87); Baltimore, MD, USA (27 Apr 1987).

Technical Paper THC2.

New theoretical models have recently been developed to describe the complex physical and chemical processes occurring in plasma processing reactors. They are based on fundamental discharge parameters such as electron energy distributions, atomic and molecular dissociation and excitation rates. To verify the models, the authors used pulsed-UV laser Raman spectroscopy to measure the dissociation of feed gases in the rf discharges used for plasma processing. Their results provide a second parameter in addition to the decomposition rate and are described.

9199 **Laser-excited fluorescence studies of gas-phase silicon atoms in silane chemical vapor deposition.** Ho, P.; Breiland, W.G.; Coltrin, M.E. (Sandia National Labs., Albuquerque, NM 87185). pp 216 of Proceedings of the conference on lasers and electro-optics. Piscataway, NJ; IEEE Service Center (1987). (CONF-870401—).

From OSA/IEEE conference on lasers and electro-optics (CLEO '87); Baltimore, MD, USA (27 Apr 1987).

Technical Paper THC4.

Laser excited flourescence was used to detect gas phase silicon atoms during chemical vapor deposition from silance. Measurements of relative silicon atom densities were made in a wide variety of conditions including temperature and pressure changes. The authors compared the Si atom density with a model developed by a previous author. They discuss the results, their data and discrepancies between the model and experiment.

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REFER ALSO TO CITATION(S) 8460, 8478, 8684, 8708, 8871, 8873, 8874, 8875, 8876, 8877, 9079, 9190, 9239, 9255, 9499, 10493

9200 **(AERE-R—11657) Iodine hydrolysis reactions. Pt. 1. Spectrophotometric iodine measurements.** Deane, A.M.; Marsh, W.R. (UKAEA Atomic Energy Research Establishment, Harwell. Chemistry Div.). Jun 1986. 18p. HMSO, London, price Pound 4.00.

Aqueous iodine spectra in the UV/visible region have been measured over the concentration range 10^{-3}M to 10^{-6}M. In addition to confirming the known iodine species absorptions, a number of tentative new assignments of absorption peaks have been made. Use of the new bands may provide the possibility of greater accuracy in the spectrophotometric determination of mixtures. Equilibrium constants, have been estimated for the following reactions: $I_2 + I_2 - I_4$ and $HIO + I^- - HI_2$. The second order rate constant, $k = 3.0+-0.8M^{-1}s^{-1}$ has been estimated for the reaction: $2HIO - IO_3^- + I^- + 2H^+$. In addition, there is evidence for additional reactions which remove I_2 from the solution, and a marked effect of impurities upon the reaction rates.

9201 **(AERE-R—11974, pp 11-27) Some studies on aqueous iodine chemistry at elevated temperatures.** Ashton, L.; Corti, H.; Turner, D.J. (Marlborough School, Oxford, GB; Comision Nacional de Energia Atomica, Buenos Aires, Argentina; Central Electricity Research Labs., Leatherhead, UK). Jan 1986. H.M. Stationery Office, London, price Pound 16.00. (CONF-8509169—).

From Specialist workshop on iodine chemistry in reactor safety organization for economic cooperation and development; Harwell, UK (9 Sep 1985).

A number of experimental techniques have been used to study two of the equilibria which control the speciation of solutions of molecular iodine in water. The I_3^- formation reaction was studied by vapour equilibration, spectrophotometric and redox electrode methods. The IO_3^- formation reaction was studied by two redox electrode systems. Possible causes of errors were considered. (U.K.).

9202 **(AERE-R—11974, pp 29-45) Disproportionation of iodine (I).** Paquette, J.; Wren, J.C.; Sunder, S.; Ford, B.L. (Atomic Energy of Canada Ltd., Pinawa, Manitoba. Whiteshell Nuclear Research Establishment). Jan 1986. H.M. Stationery Office, London, price Pound 16.00. (CONF-8509169—).

From Specialist workshop on iodine chemistry in reactor safety organization for economic cooperation and development; Harwell, UK (9 Sep 1985).

We have studied the kinetics of disproportionation of iodine (I) in aqueous solutions, using Raman spectroscopy and ultraviolet-visible spectrophotometry. The Raman spectroscopic measurements provided an unambiguous identification of the reaction intermediates, whereas the UV-visible spectrophotometric data provided accurate values of the rate constants. The reaction was found to be second order in OI^- and first order in I^- at high OH^- concentrations. Two reaction paths were identified; one involves two IO^- molecules and the other involves IO^- and the weak complex HOI_2^-. The intermediate species IO_2^- was also identified by Raman spectroscopy. The reaction was found to be second order in HOI in the pH range 3.5 to 12. It is catalyzed by borate and phosphate ions.

9203 **(AERE-R—11974, pp 47-61) Iodine hydrolysis reactions; preliminary species identification and rate measurements.** Deane, A.M. (UKAEA Atomic Energy Research Establishment, Harwell. Chemistry Div.). Jan 1986. H.M. Stationery Office, London, price Pound 16.00. (CONF-8509169—).

From Specialist workshop on iodine chemistry in reactor safety organization for economic cooperation and development; Harwell, UK (9 Sep 1985).

Curve-fitting techniques have been used with time-resolved spectra of aqueous iodine solutions to measure the parameters of absorption bonds in the electronic spectra of the solutions. Data were combined with a FACSIMILE computer model of the hydrolysis reactions to provide rate constants for the individual reactions. Measurements have been completed for a $2x10^{-6}$ M solution of iodine in pure water, and for similar solutions containing silver ions; a set of rate constants was derived which fits all these solutions. (U.K.).

9204 (AERE-R—11974, pp 63-89) **Kinetics of iodine release from aqueous solutions.** Wren, D.J.; Paquette, J. (Atomic Energy of Canada Ltd., Pinawa, Manitoba. Whiteshell Nuclear Research Establishment). Jan 1986. H.M. Stationery Office, London, price Pound 16.00. (CONF-8509169—).

From Specialist workshop on iodine chemistry in reactor safety organization for economic cooperation and development; Harwell, UK (9 Sep 1985).

A model for predicting the time-dependent release of iodine from aqueous solutions following accidents in nuclear power reactors, has been formulated, using elementary chemical reactions. The model has been used to calculate the partition-coefficients for iodine as a function of several important parameters. The importance of pH and the presence of a strong radiation field on the partition coefficient is demonstrated. (U.K.).

9205 (AERE-R—11974, pp 91-103) **Data base for the reaction kinetics of iodine in aqueous solution.** Sellers, R.M. (Central Electricity Generating Board, Berkeley, UK. Berkeley Nuclear Labs.). Jan 1986. H.M. Stationery Office, London, price Pound 16.00. (CONF-8509169—).

From Specialist workshop on iodine chemistry in reactor safety organization for economic cooperation and development; Harwell, UK (9 Sep 1985).

This paper describes the setting up of a data base for the reaction kinetics of inorganic iodine species in solution for use in the simulation of iodine chemistry in the laboratory or in water-cooled reactor faults. A number of specific problems are highlighted. These include the rather poor quality of much of the literature kinetic data, the paucity of data for a number of key reactions (gas-liquid partitioning, radiolytic processes, metal ion catalysis, production of organic iodides), and the difficulties inherent in extrapolating laboratory data obtained at relatively high iodine concentrations ($>10^{-4}$ M) to the concentrations typical of reactor faults ($<10^{-6}$ M). Specific examples are given to illustrate these points. Despite the shortcomings the data base established reproduces well a number of alternative results including those obtained in radiolytic systems, and in the oscillating Bray-Liebhafsky reaction, the latter a particularly severe test of any mechanism. Typical applications in reaction safety analysis are indicated with reference to fuel pond faults.

9206 (AERE-R—11974, pp 104) **Discussion on iodine equilibria and kinetics in aqueous solution.** Vikis, A.C.; Wren, D.J.; Paquette, J.; Potter, P.E.; Buxton, G.V. (Atomic Energy of Canada Ltd., Pinawa, Manitoba. Whiteshell Nuclear Research Establishment; UKAEA Atomic Energy Research Establishment, Harwell. Chemistry Div.; Leeds Univ., UK. Cookridge High Energy Radiation Research Centre). Jan 1986. H.M. Stationery Office, London, price Pound 16.00. (CONF-8509169—).

From Specialist workshop on iodine chemistry in reactor safety organization for economic cooperation and development; Harwell, UK (9 Sep 1985).

Iodine equilibria and kinetics in aqueous solutions were discussed. The desirability of collecting up-to-data tables on spectral, thermodynamic and rate-constant data is emphasised. Measurements of the equilibrium constant as a function of temperature have been carried out. (U.K.).

9207 (AERE-R—11974, pp 121-137) **Thermal and radiolytic oxidation of aqueous I^- and the hydrolysis and disproportionation of aqueous I_3.** Burns, W.G.; Marsh, W.R. (UKAEA Atomic Energy Research Establishment, Harwell. Chemistry Div.). Jan 1986. H.M. Stationery Office, London, price Pound 16.00. (CONF-8509169—).

From Specialist workshop on iodine chemistry in reactor safety organization for economic cooperation and development; Harwell, UK (9 Sep 1985).

This report presents background studies of the processes whereby iodine, released into the environment after a reactor accident, may undergo hydrolysis and disproportionation reactions which convert it into volatile IO_3^- and I^-. The processes are studied at a number of temperatures and are intended to be of use in reactor accident assessment. Results are compared with work from other laboratories. (U.K.).

9208 (AERE-R—11974, pp 253-274) **Interaction of caesium iodide with boric acid.** Beattie, I.R.; Gilson, T.R.; Jones, P.J.; Bowsher, B.R. (Southampton Univ., GB. Dept. of Chemistry; UKAEA Atomic Energy Establishment, Winfrith). Jan 1986. H.M. Stationery Office, London, price Pound 16.00. (CONF-8509169—).

From Specialist workshop on iodine chemistry in reactor safety organization for economic cooperation and development; Harwell, UK (9 Sep 1985).

The behaviour of caesium iodide and orthoboric acid (H_3BO_3) under a variety of experimental conditions is discussed. The difficulty of completely dehydrating boric oxide (B_2O_3) even at temperatures of the order of 1000°C is emphasised. Experimental work on the boric acid/caesium iodide system is reported at temperatures in the region of 600°C under a variety of conditions. The results obtained can be interpreted in terms of (a) the liberation of hydrogen iodide (together with partial decomposition to hydrogen and iodine) in the absence of oxygen, and (b) the liberation of much greater quantities of iodine in the presence of oxygen.

9209 (AERE-R—11974, pp 275-289) **Interaction of caesium iodide with boric acid in the temperature range 100 to 1000°C.** Bowsher, B.R.; Dickinson, S.; Bruce, D.M. (UKAEA Atomic Energy Establishment, Winfrith; UKAEA Atomic Energy Research Establishment, Harwell. Energy Technology Div.). Jan 1986. H.M. Stationery Office, London, price Pound 16.00. (CONF-8509169—).

From Specialist workshop on iodine chemistry in reactor safety organization for economic cooperation and development; Harwell, UK (9 Sep 1985).

The interaction of cesium iodide with boric acid has been studied over the temperature range 100°C - 1000°C under a variety of conditions. Experiments have been performed to characterise the mechanism and products of the reaction and to assess the likelihood and extent of the reaction occurring in severe reactor accidents.

9210 (AERE-R—11974, pp 317-332) **Formation of organic iodides under reactor accident conditions.** Saeki, M. (Japan Atomic Energy Research Inst., Tokai, Ibaraki. Tokai Research Establishment). Jan 1986. H.M. Stationery Office, London, price Pound 16.00. (CONF-8509169—).

From Specialist workshop on iodine chemistry in reactor safety organization for economic cooperation and development; Harwell, UK (9 Sep 1985).

The formation mechanism of organic iodides has been experimentally established, that is, organic iodides are formed by the reaction of elemental iodine with organic radicals produced from organic impurities. This mechanism is common in either case, to homogenous reactions in gaseous and aqueous phases or to surface reactions. The possibility of organic iodides formation was discussed on the basis of the above mechanism for three stages in a reactor accident.

9211 (AERE-R—11974, pp 333-357) **Formation and volatility of organic iodides.** Wren, J.C.; Paquette, J.; Wren, D.J.; Sanipelli, G.G. (Atomic Energy of Canada Ltd., Pinawa, Manitoba. Whiteshell Nuclear Research Establishment). Jan 1986. H.M. Stationery Office, London, price Pound 16.00. (CONF-8509169—).

From Specialist workshop on iodine chemistry in reactor safety organization for economic cooperation and development; Harwell, UK (9 Sep 1985).

The kinetics of iodination of phenol in aqueous solutions at pH values between 3 and 5 have been studied using a flow system. The reaction was found to occur predominantly by a mechanism in which HOI attacks non-ionized phenol in a reversible process to give an intermediate, which then loses a proton to yield iodophenol. We have also measured the vapour pressure and aqueous solubility of triiodomethane as a function of temperature. From these data, the standard thermodynamic properties of triiodomethane have been calculated. The latter study is part of a program to generate thermodynamic data required to calculate organic iodide volatilities in aqueous solution.

9212 (AERE-R—11974, pp 358) **Discussion on organic iodine compounds.** Beahm, E.C.; Neeb, K.-H.; Bowsher, B.R.; Vikis, A.C.; Paquette, J. (Oak Ridge National Lab., TN, USA; Kraftwerk Union A.G., Erlangen, Germany, F.R.; UKAEA Atomic Energy Establishment, Winfrith; Atomic Energy of Canada Ltd., Pinawa, Manitoba. Whiteshell Nuclear Research Establishment). Jan 1986. H.M. Stationery Office, London, price Pound 16.00. (CONF-8509169—).

From Specialist workshop on iodine chemistry in reactor safety organization for economic cooperation and development; Harwell, UK (9 Sep 1985).

Work done on the behaviour of organic iodine compounds includes large containment experiments, reaction kinetics, formation of organic iodides, analysis of iodine species and gas chromatography.

9213 (DOE/ER/13619—T1) **Vibrational spectra and normal coordinate analysis of tris-bipyridine ruthenium (II).** Mallick, P.K.; Danzer, G.D.; Strommen, D.P.; Kincaid, J.R. (Marquette Univ., Milwaukee, WI (USA). Dept. of Chemistry). 1987. Contract FG02-86ER13619. 27p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88002670/JAW.

The infrared and resonance Raman spectra of the tris-bipyridine ruthenium(II) complex and several of its deuterated analogues are reported; specifically, those of the complexes of 3,3′-dideutero-2,2′-bipyridine, 6,6′-dideutero-2,2′-bipyridine and perdeutero-2,2′-bipyridine. Multiple excitation lines are employed to obtain the resonance Raman spectra in order to facilitate observation of all A_1 fundamental vibrations associated with the ligand framework. Normal coordinate calculations are carried out employing a systematic procedure based on a modified valence force field which is comparable to those used previously for aromatic molecules. The resultant (30 force constant) field reproduces observed frequencies with an average error of ~2%. 28 refs., 3 figs., 3 tabs.

9214 (DOE/ER/13653—1) **[Utilization of magnetic effects as a means of isotopic enrichment]: Technical progress report, January 1, 1987 to August 31, 1987.** (Columbia Univ., New York (USA)). 1987. Contract FG02-87ER13653. 3p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88003473/JAW.

A quantitative theory was developed. Structural variations that would enhance the efficiency of the ^{13}C isotope separation were explored. Photolysis of substituted large ring cyclic ketones resulted in efficient separations. (DLC)

9215 (EUR—10346) **Study of the vapor-liquid equilibria used in the fabrication process of hydrogen by thermochemistry: Final report.** Berthelot, P.; Houzelle, C.; Laugier, S.; Legret, D.; Muehbauer, R.; Renon, H.; Richon, D. (Association pour la Recherche et le Developpement des Methodes et Processus Industriels (ARMINES), 75 - Paris (France)). 1986. 55p. (In French). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88900239/JAW.

Two new flow apparatuses have been designed and constructed to determine vapor-liquid equilibria of very corrosive components. Main differences between the two apparatuses are their temperature and pressure ranges of operation. When using each of the two equipments, a monophasic mixture is introduced continuously at constant pressure into a thermostated equilibrium coil. The vapor and liquid leave the coil at equilibrium and enter a separator from which each phase is withdrawn continuously to maintain a constant level of the interface in the separator. Samples taken from the outcoming flows are analyzed. The first apparatus (medium temperature-low pressure) was developed to test the new dynamic method. The experimental results obtained for the system water-acetic acid are in good agreement with those of Othmer et al. (1952). The second apparatus for measurements up to 50 bar and 823°K was used to obtain SO_2-H_2O equilibrium data. The results obtained are presented; at low pressures they are in good agreement with tabulated data of Gmitro and Vermeulen (1963, 1964).

9216 (INIS-mf—11052, pp vp) **Synthesis of chromium(V) complex based on deuterated athanediol for a polarized deuteron target.** Bunyatova, Eh.I. (Joint Inst. for Nuclear Research, Dubna, USSR). 1985. (In Russian). NTIS (US Sales Only), PC A19/MF A01. Order Number DE88700667/JAW. (CONF-8509430—).

From International summer school on hyperfine interactions and international study meeting: physics with oriented nuclei; Bechyne, Czechoslovakia (2 Sep 1985).

9217 (LBL—22075, pp 1-13) **Surface science and catalysis.** Apr 1987. NTIS, PC A06/MF A01. Order Number DE88000686/JAW.

In Center for Advanced Materials: Annual report, 1986.

The Surface Science and Catalysis Program is designed to develip new and improved surface materials and processes. Current research interests are focused in two areas: Heterogeneous catalysis and coatings. Work in heterogeneous catalysis is centered on the synthesis and characterization of microporous crystalline materials including zeolites and transition metal carbides and nitrides. In the field of coatings, research is focused on plasma assisted deposition of hard coatings including titanium nitride and hard carbon and on the production of surface compounds that form at metal-oxide and metal-metal interfaces. The interface properties are characterized with a combination of modern surface science techniques. 34 refs., 6 figs.

9218 **Approximate design of multiple-feed/side-stream distillation systems.** Nikolaides, I.P.; Malone, M.F. (Chemical Engineering Dept., Goessmann Lab., Univ. of Massachusetts, Amherst, MA 01003). *Industrial and Engineering Chemistry Research;* **26**: No. 9, 1839-1844(Sep 1987).

An approximate, equation-based design method is presented to describe the separation of multicomponent mixtures in multiple-feed towers with or without side streams. Simple expressions for the selection of the controlling feed and the determination of feasible side-stream compositions are found. Several counterintuitive results are found. It is shown that the minimum reflux, rather than the boiling point, is a better criterion for ordering feeds to the column. For example, vapor rates are sometimes reduced by placing lower boiling point feeds below higher boiling point feeds in multiple-feed columns. Complex configurations, using multiple-feed and side-stream columns, can reduce the operating costs for distillation without large increases in capital costs. Examples are shown with vapor-rate savings as large as 30%. These complex column arrangements may be useful in process retrofits.

9219 Equilibrium adsorption of multicomponent gas mixtures at elevated pressures. Ritter, J.A.; Yang, R.T. (Dept. of Chemical Engineering, State Univ. of New York at Buffalo, Buffalo, NY 14260). *Industrial and Engineering Chemistry Research;* **26**: No. 8, 1679-1685(Aug 1987).

Equilibrium adsorption of H/sub 2/, CO, CH/sub 4/, CO/sub 2/, and H/sub 2/S (single and mixed gases-two to five species) was measured on activated carbon at pressures up to 400 psia. Temperature-dependent parameters, regressed from single-gas data, were applied to four theoretical models which predict adsorption from gas mixtures. Deviations between theory (IAS) and experiment increased with pressure and with the number of components in the mixture. None of the theories employing only single-gas data could consistently predict multicomponent adsorption. It was found that multicomponent adsorption could be predicted from the extended Langmuir equation by including an interaction parameter calculated from only single and binary data. In the application of mixture adsorption theories, it was shown that from the same model significantly different results can be obtained depending on the selection of the independent set, {T, P, X/sub i/} or {T, P, Y/sub i/}.

9220 Correlation of vapor-liquid equilibria for the system ammonia-carbon dioxide-water. Kawazuishi, K.; Prausnitz, J.M. (Materials and Molecular Research Div., Lawrence Berkeley Lab., and Dept. of Chemical Engineering, Univ. of California, Berkeley, CA 94720). *Industrial and Engineering Chemistry Research;* **26**: No. 7, 1482-1484(Jul 1987). Contract AC03-76SF00098.

New parameters are given for a previously published correlation for calculating vapor-liquid equilibria in aqueous systems containing volatile weak electrolytes. Particular attention is given to ternary aqueous mixtures containing ammonia and carbon dioxide. When the new parameters are used, good agreement is obtained with recent experimental data.

9221 Stability of tubular and autothermal packed bed reactors using phase plane analysis. Chylla, R.W. Jr.; Adomaitis, R.A.; Cinar, A. (Dept. of Chemical Engineering, Illinois Institute of Technology, Chicago, IL 60616). *Industrial and Engineering Chemistry Research;* **26**: No. 7, 1356-1361(Jul 1987).

The regions of stability and parametric sensitivity of countercurrent reactor/heat exchangers are determined explicitly in the plane of inlet feed temperature-inlet coolant temperature. The concept of phase plane analysis is generalized to include all orders of reaction rate expressions, a broader range of system parameters, and is extended to the case of autothermal reactors. An industrial hydrocarbon oxidation reactor model and an autothermal CO oxidation reactor model have been used to illustrate and to evaluate the analysis method. The approach presented here is appealing since the region of safe inlet temperatures is determined explicitly and the region of safe operation can be optimized with respect to the reactor design parameters.

9222 Mechanism for alkali metal-catalyzed CO_2 gasification of carbon. Saber, J.M. Boulder, CO; Univ. of Colorado (1987). 196p. University Microfilms Order No. 87-16,296.Contract FG22-82PC50798.

Thesis (Ph. D.).

Alkali metal-catalyzed gasification of carbon by CO_2 was studied using Temperature-programmed reaction and isotopic tracers. Between 500 and 1000 K, oxide groups on the carbon surface interact with potassium carbonate to form carbonate/oxygen/carbon complexes. The complexes exchange carbon and oxygen isotopes readily with gas-phase carbon dioxide. Sodium carbonate, however, does not appear to complex with the surface oxide groups under these conditions. The surface oxide groups also stabilize potassium on the carbon surface, thus, less potassium volatilizes from higher-oxygen-content carbons than from lower oxygen content carbons. Above 1000 K, both potassium and sodium carbonate decompose coincident with catalyzed CO_2 gasification to form a metal oxide with a metal:oxygen ratio of 2. The oxide can be oxidized to give a metal:0 ratio of 1. The carbonate does not appear to be the catalytically active species. Reactions describing Na-catalyzed gasification via oxygen. Transfer mechanisms are proposed.

9223 Direct observation of O-xylylene (o-quinodimethane) in solution. Dimerization kinetics of some o-quinodimethanes. II. Kinetic and product studies on the dimerization of α-methyl-substituted of o-quinodimethanes. III. Direct observation of 1,2-napthoquinodimethane and 9,10-phenanthroquinodimethane. Dimerization kinetics of resonance-stabilized o-quinodimethanes. Macias, J.R. Ames, IA; Iowa State Univ. (1987). 159p. University Microfilms Order No. 87-16,791.Contract W-7405-ENG-82.

Thesis (Ph. D.).

Fluoride ion induced 1,4-elimination from [o[(trimethylsilyl)methyl]benzyl]trimethylammonium iodide (7) has been used to generate o-xylylene (1) in solution. o-Xylylene (1) was observed directly in solution by UV-visible spectroscopy. Using stopped-flow UV-visible spectroscopy it was determined that the dimerization of 1 follows second-order kinetics. Two ring-alkylated derivatives of 1, 4-t-butyl-1,2-xylylene (28) and 3,4-(1,1,3,3-tetramethyltrimethylene)-1,2-xylylene (29) were generated and observed by UV-visible spectroscopy. The rate constant for the dimerization of 28 of 29 was determined, and the similar rate constants observed for the dimerization of 1, 28, and 29 led to the conclusion that when undergoing dimerization the o-quinodimethane monomers prefer a non-endo approach. The dimerization kinetics of 5-ethylidene-6-methylene-1,3-cyclohexadiene (9) and 5,6-bis(ethylidene)-1,3-cyclohexadiene (10) were studied by stopped-flow UV-visible spectroscopy. The dimerization of 9 and 10 led predominantly to one stereoisomer in each case. The similar rate constants for the dimerization of o-xylylene (1) and 9, and the much slower rate constant observed for the dimerization of 10 provided evidence for a stepwise mechanism for the dimerization of benzenoid o-quinomethanes. The fluoride ion induced 1,4-elimination methodology used in the generation of o-xylylene (1) was utilized in the formation and observation of 1,2-napthoquinodimethane (2) and 9,10-phenanthroquinodimethane (3). o-Quinodimethane (2) was observed in solution by UV-visible spectroscopy while 3 was observed by ^1H NMR spectroscopy. Both of these species were considerably more stable than 1. Both 2 and 3 dimerized following second-order kinetics.

9224 Gas-phase intramolecular Diels-Alder reactions of 2,3-dimethylene-2,3-dihydrofurans. II. Formation of anthracene and other polycyclic aromatic compounds in the pyrolysis of 1,5-bidenzocyclooctadienes and related compounds. III. Formation of 9-methylanthracene and anthracene in the pyrolysis of 5,6,11,12-tetrahydrodibenzo(A,E)cyclooctene and other related compounds. IV. Preparation of cyclopentadienones by flash vacuum pyrolysis and their dimerization and intramolecular reactions. Lee, S.K. Ames, IA; Iowa State Univ. (1987). 221p. University Microfilms Order No. 87-16,787.Contract W-7405-ENG-82.

Thesis (Ph. D.).

The intramolecular Diels-Alder reactions of 2,3-dimethylene-2,3-dihydrofurans have been investigated through the pyrolysis of 2-alkenyl-3-furylmethyl benzoates. Under flash vacuum pyrolysis (FVP) conditions each of the 2,3-dimethylene-2,3-dihydrofurans can undergo an intramolecular Diels-Alder reaction or 1,5-hydrogen shift to give the corresponding tricycles 4c,t, 5c,t, and 6c,t and 1,5-hydrogen shift products 36c,t and 37c,t. FVP of 1,5-dibenzocyclooctadienes containing heteroatoms and dibenzosuberanes gave the corresponding tricyclic compounds [benzodifuran (18), acridine (24), and anthracene] with exception of 6H, 11H-dibenzo[b,f][1,4]-dioxocin (17). The FVP of 17 gave (2-hydroxybenzyl)-o-benzaldehyde (28) as a major product. A mechanistic study of the regiospecific formation of 9-methyl-anthracene from the sealed tube pyrolysis the [4 + 4] dimer of o-xylylene (1) is presented. This study was carried out by pyrolyzing several possible precursors for 9-methylanthracene (e.g., 5,6-dihydrodibenzo[a,e]cyclooctene, di-o-tolylethane, and 5-methyldibenzosuberane). Sealed tube pyrolyses of dibenzosuberanes and dibenzosuberones were also carried out. A new method of preparing cyclopentadienones by the pyrolysis of cyclic diethers is presented. Cyclopentadienones including inden-2-one have been utilized in the synthesis of polycyclic compounds. The transient existence of these intermediates has also been proven by the isolation of polycyclic compounds.

9225 **Coherent electronic energy transfer and nonlinear polariton effects in anthracene-doped naphthalene crystals.** Connolly, M.A. Ames, IA; Iowa State Univ. (1987). 136p. University Microfilms Order No. 87-16,753.Contract W-7405-ENG-82.

Thesis (Ph. D.).

The nature of electronic energy transfer in strain-free mounted anthracene-doped naphthalene single crystals at frequencies near that of the (0.0) a-exciton in naphthalene was probed using sensitized resonant two-photon fluorescence excitation (TPE) and second harmonic generation (SHG) spectroscopies. The naphthalene-to-anthracene TPE intensity ratios were found to be 1.2 and 1.6, for excitation of the zero-phonon transition at 1.6 K and 20 K, respectively. This result is consistent with coherent exciton-polariton electronic energy transfer at liquid helium temperatures, and incoherent transfer at high temperatures. Energy transfer for the pure and the anthracene-doped naphthalene systems under investigation was determined to be in the capture limited regime. The polariton trapping event is discussed in terms of scattering off a trap with subsequent trapping (i.e., capture) and scattering off a trap without subsequent trapping (i.e., trap scattering). Thermal broadening and temperature dependences of the TPE and SHG signal intensities for both naphthalene and anthracene are presented and are discussed in terms of the polariton fusion model. The experimental data do not agree with the theoretical predictions; this discrepancy is discussed in terms of the anomalous crystal habit (diamond plates) observed in the present investigation. The first report of a longitudinal exciton in a doped organic molecular system also is reported.

9226 **Application of the Carnahan-Starling-DeSantis equation of state to mixtures of refrigerants.** Morrison, G.; Mc Linden, M.O. New York, NY; American Society of Mechanical Engineers (1987). 8p. (CONF-861211—). American Society of Mechanical Engineers, 345 East 47 St., New York, NY 10017.

From American Society of Mechanical Engineers winter meeting; Anaheim, CA, USA (7 Dec 1986).

Technical Paper 86-WA/HT-59.

A modification to the Carnahan-Starling equation of state to describe the properties of refrigerant materials and their binary and ternary mixtures is discussed. A detailed discussion of the ability to fit and predict the thermodynamic properties of R22 is included. The representations arising from limited and extensive data sets are compared. The binary mixture R22/R114 is discussed and compared briefly to other binary refrigerant mixtures. The ability of this model to describe ternary mixtures without any ternary information is discussed. Present uses of this model are described.

9227 **Large molecule electronic sputtering by plasma desorption and heavy-ion bombardment.** Hunt, J.E. (Chemistry Div., Argonne National Lab., Argonne, IL 60439). pp 181-187 of Particle and photon interactions with surfaces. Gruen, D.M.; Krauss, A.R.; Pellin, M.J.; Young, C.E. New York, NY; Elsevier Science Pub. Co. Inc. (1987). (CONF-860807—). Contract W-31-109-ENG-38.

From 6. international workshop on inelastic ion surface collisions; Argonne, IL, USA (25 Aug 1986).

Particle-induced electronic sputtering mass spectrometry of organic compounds is described. The differences between fast ion (electronic energy loss) and slow ion (nuclear energy loss) in desorption processes are discussed. Recent results in the field are presented and discussed in terms of heavy-ion desorption. Illustrations of the analytical application of the technique are presented.

4004 Electrochemistry

REFER ALSO TO CITATION(S) 8952, 9079

9228 **Anodic oxygen-transfer electrocatalysis at pure and modified lead dioxide electrodes in acidic media.** Yeo, I.H. Ames, IA; Iowa State Univ. (1987). 221p. University Microfilms Order No. 87-16,842.Contract W-7405-ENG-82.

Thesis (Ph. D.).

Pure β-lead dioxide and lead dioxide doped heavily with other metal oxides were prepared by electrochemical deposition on a gold, rotated disc electrode (RDE) in 1.0 M $HClO_4$. These electrodes were compared for their electrocatalytic support of anodic reactions accompanied by transfer of oxygen from the aqueous solvent to the reaction product. The heterogeneous rate constants of several inorganic and organic reactions were determined. The electrocatalytic effects of numerous dopants were determined, and bismuth oxide was found to cause the greatest increase in rates of anodic oxygen-transfer reactions. Physical properties of the bismuth mixed lead oxide electrodes were examined by x-ray diffraction (XRD), Auger electron spectroscopy (AES), and scanning electron microscopy (SEM). The increased values of the heterogeneous rate constant for oxygen-transfer reactions caused by increased levels of bismuth in the mixed oxide electrodes was found to be accompanied by a decrease in the overpotential for anodic evolution of O_2. These kinetic properties also were found to be correlated with an increasing preferred orientation of the electrodeposited mixed oxide in which the (020) plane of the slightly distorted rutile structure was oriented parallel to the geometric surface of the disc electrode. The (020) plane has the highest ratio of oxygen:metal per unit area. A general mechanistic consideration is given for anodic oxygen-transfer electrocatalysis based on the increased activity of surface oxygen at the mixed oxide electrodes.

9229 **Reference electrodes for molten electrolytes.** Minh, N.Q.; Redey, L. (Argonne National Lab., IL). pp 105-287 of Molten salt techniques. Volume 3. Lovering, D.G.; Gale, R.J. (eds.). New York, NY; Plenum Press (1987).

Because molten salts are ionic liquids, they are useful in testing ionic theories and models, and provide a medium for studying various phenomena and processes without the presence of water. In most cases, electrochemical measurements require the use of a reference electrode, and the success of the measurements depends to a large extent on the reliability of that electrode. Several types of reference electrodes are commercially available for use in aqueous systems. However, molten salt reference electrode are always custommade; therefore, the selection of a suitable reference electrode for a molten salt system is a major task and it is usually necessary to consider what is the best reference electrode for each molten salt system. The authors present a treatise on the practical aspects of reference electrodes in molten salts placing emphasis on providing the details of and suggestions on construction and operational characteristics of different reference electrodes. Some discussion of theory pertaining to the operation of reference electrodes is also included. In this chapter the design, construction, operation, and limitation of various reference electrodes in common molten salt systems are discussed. A brief review of theoretical principles concerning reference electrodes is given in Section 2 followed by a general discussion on principles of reference electrode construction and application in Section 3. Detailed descriptions of reference electrodes in various molten salt systems (chlorides, bromides, iodides, chloroaluminates, fluorides, cryolites, nitrates, carbonates, sulfates, hydroxides), are presented in Section 4.

4005 Photochemistry

9230 **(CONF-8705225—1) Picosecond laser spectroscopy of charge-separation in photosynthetic model systems.** Schaafsma, T.J.; Hofstra, U.; Koehorst, R.B.M.; Sanders, G.M.; van der Plas, H.C. (Argonne National Lab., IL (USA); Landbouwhogeschool Wageningen (Netherlands)). 1987. Contract W-31109-ENG-38. 3p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE88003122/JAW.

From Conference on modern methods of laser spectroscopy of molecules in low temperature media; Tallinn, USSR (18 May 1987).

Charge-separation in synthetic donor-pigment-acceptor (DPA) compounds and concentration dimers of porphyrins was investigated by fluorescence quenching, EPR-spectroscopy and picosecond optical absorption spectroscopy.

4006 Radiation Chemistry

REFER ALSO TO CITATION(S) 8529, 8871, 8876, 9141, 9204, 9207, 9769, 9901, 9902

9231 (AERE-R—11974, pp 107-120) **Radiolytic formation and reactivity of aqueous hypoiodous acid.** Fletcher, J.W.; Miller, O.A. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.). Jan 1986. H.M. Stationery Office, London, price Pound 16.00. (CONF-8509169—).

From Specialist workshop on iodine chemistry in reactor safety organization for economic cooperation and development; Harwell, UK (9 Sep 1985).

Hypoiodous acid (HOI) can be formed in: (a) the radiolytic oxidation of iodide in nitrous oxide saturated aqueous solution or; (b) the radiolytic reduction of iodate in hydrogen saturated aqueous solution. The reaction of HOI which is in equilibrium with molecular iodine, was followed by monitoring the loss of iodine and or the formation of iodide using a UV-VIS Rapid Scan Spectrophotometer. The HOI reacts mainly with the radiolytically formed hydrogen peroxide to give the iodide ion. The removal of HOI due to disproportionation is not significant. In iodate solutions, iodide, either added or as a decay product, reacts with the HOI in neutral or acidic solutions to form measurable quantities of iodine. As iodine does not react significantly with hydrogen peroxide, the decay rate is reduced as the fraction of iodine increases during the decay.

9232 (AERE-R—11974, pp 139-149) **Effect of radiolysis on the chemical forms of iodine species.** Ishigure, K.; Shiraishi, H.; Okuda, H.; Uchida, J.; Yoshitani, Y.; Fujita, N. (Tokyo Univ., Japan. Faculty of Engineering; Industrial Research Inst., Tokyo, Japan). Jan 1986. H.M. Stationery Office, London, price Pound 16.00. (CONF-8509169—).

From Specialist workshop on iodine chemistry in reactor safety organization for economic cooperation and development; Harwell, UK (9 Sep 1985).

The effect of radiation on chemical iodine forms was examined by the product analysis and pulse radiolysis technique. The deaerated solutions of 10^{-4}, 10^{-5} and 10^{-6}M cesium iodide were irradiated with gamma rays, and then analysed for iodine species, H_2O_2, O_2 and H_2 as radiolysis products. It was found that a subtle balance between oxidation and reduction of iodide ions is attained after relatively small doses of radiation. The rate constants of some important reactions involved were measured by pulse radiolysis.

9233 (AERE-R—11974, pp 151-165) **Formation and stability of hypoiodous acid in irradiated iodide solution.** Buxton, G.V.; Kilner, C.; Sellers, R.M. (Leeds Univ., UK; Central Electricity Generating Board, Berkeley, UK. Berkeley Nuclear Labs.). Jan 1986. H.M. Stationery Office, London, price Pound 16.00. (CONF-8509169—).

From Specialist workshop on iodine chemistry in reactor safety organization for economic cooperation and development; Harwell, UK (9 Sep 1985).

The formation of hypoiodous acid in the radiation-induced oxidation of iodine in unbuffered dilute aqueous solutions is studied. Hypoiodous acid is sufficiently thermally stable for its radiation chemistry to be important. Pulse radiolysis experiments demonstrated that HOI reacts rapidly with the hydrated electron. The mechanism of the radiation-induced interconversion of iodide and iodate is discussed. (U.K.).

9234 (AERE-R—11974, pp 167-184) **Radiolysis of cesium iodide solutions in conditions related to those prevailing in a pressurized water reactor after severe core damage.** Lucas, M. (CEA Centre d'Etudes Nucleaires de Cadarache, Saint-Paul-les-Durance, FR. Inst. de Protection et de Surete Nucleaire). Jan 1986. H.M. Stationery Office, London, price Pound 16.00. (CONF-8509169—).

From Specialist workshop on iodine chemistry in reactor safety organization for economic cooperation and development; Harwell, UK (9 Sep 1985).

Measurements were made of I_2 and IO_3^- formed when aqueous CsI solutions were exposed to two temperatures 43° and 95°C with irradiation. Parameters varied were time, dose, CsI concentration, boric acid concentration, Cs_2CO_3 concentration, in the presence of air, air-carbon dioxide, and air-carbon dioxide-hydrogen mixtures, to provide information for calculation of the form in which iodine released from fuel as CsI in a reactor accident might reach the environment. In some experiments a two-compartment cell was used in order to trap the gaseous iodine produced. In this case it was found that the quantity of gaseous iodine produced increased roughly linearly with the dose (at the dose rate used). In addition it was found that IO_3^- is radiolyzed into I^- and I_2.

9235 (AERE-R—11974, pp 185-192) **Gas phase radiation chemistry of iodine in post-accident environments.** Vikis, A.C.; Torgerson, D.F. (Atomic Energy of Canada Ltd., Pinawa, Manitoba. Whiteshell Nuclear Research Establishment). Jan 1986. H.M. Stationery Office, London, price Pound 16.00. (CONF-8509169—).

From Specialist workshop on iodine chemistry in reactor safety organization for economic cooperation and development; Harwell, UK (9 Sep 1985).

In certain postulated nuclear reactor accidents, the containment building air would be subjected to radiation doses of the order of 1 $kGy.h^{-1}$, due to the presence of radioactive noble gases. We examine here the impact of ozone, which could be produced by the radiolysis of oxygen in air, on radioiodine concentrations in the containment building atmosphere. In the gas phase, molecular iodine (I_2) reacts with ozone to form iodine oxides that, on contact with water, would be washed into the aqueous phase in the form of IO_3^-(aq). We conclude that even minor concentrations of ozone, 0.1 to 1 $\mu l/l$ in air, could attenuate significantly the airborne concentration of molecular radioiodine. This reaction path could thus serve as a "built-in" chemical sink, which would attenuate airborne radioiodine and thus mitigate the radiological consequences of the accident.

9236 (AERE-R—11974, pp 193-200) **Effects of β-, γ-radiolysis on cesium iodide solutions in contact with simulated silver metal aerosol.** Furrer, M.; Gloor, T. (Eidgenoessisches Inst. fuer Reaktorforschung, Wuerenlingen, Switzerland). Jan 1986. H.M. Stationery Office, London, price Pound 16.00. (CONF-8509169—).

From Specialist workshop on iodine chemistry in reactor safety organization for economic cooperation and development; Harwell, UK (9 Sep 1985).

While silver-free, air saturated cesium iodide solutions (1 mMole CsI/l, pH 7) are rather stable even in a strong radiation field (Co-60; 0.5 Mrad/h; 30°C), the addition of silver metal as 2 μ-particles produces significant changes. Even without irradiation and in total darkness, more than half of the cesium iodide is converted to silver iodide within 10 hours at room temperature. The described β-, γ-field accelerates silver iodide formation by a factor of roughly three. In all these experiments, a steady state fraction of elemental iodine of typically 0.4% with 0.1% as an absolute minimum is encountered. This steady state concentration of a volatile iodine species so far lacks a theoretical explanation.

9237 (AERE-R—11974, pp 201-205) **Discussion on radiolysis of iodine species.** Powers, D.; Beahm, E.C.; Buxton, G.V. (Sandia National Labs., Albuquerque, NM, USA; Oak Ridge National Lab., TN, USA; Leeds Univ., UK. Cookridge High Energy Radiation Research Centre). Jan 1986. H.M. Stationery Office, London, price Pound 16.00. (CONF-8509169—).

From Specialist workshop on iodine chemistry in reactor safety organization for economic cooperation and development; Harwell, UK (9 Sep 1985).

The discussion following the session on the radiolysis of iodine species included comments on the importance of studying impurities in sump water following a reactor accident and how they might affect iodine chemistry; the formation of organic iodides, the presence of H_2O_2 in sump water, and measurements of iodine partition. The understanding of the radiolysis of iodine solutions is important in the design of BWRs. (U.K.).

9238 **(CONF-870701—9) Effects of energy, distance and orientation on electron transfer rates studied by pulse radiolysis in organic media.** Miller, J.R. (Argonne National Lab., IL (USA)). 1987. Contract W-31109-ENG-38. 6p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88002906/JAW.

From 8. international congress of radiation research; Edinburgh, UK (19 Jul 1987).

In the past few years the methods of radiation chemistry in organic media have made an enormous change in how we view electron transfer processes, as these media have proved the most useful for studying long distance electron transfer between molecules. This paper briefly summarizes a few of the aspects of this area and discusses some of the attributes and limitations of radiation tehniques, particularly pulse radiolysis, in organic solvents. 14 refs., 2 figs.

9239 **(CONF-871038—8) Hydrolytic and radiolytic degradation of OphiD(iB)CMPO: Continuing studies.** Nash, K.L.; Gatrone, R.C.; Clark, G.A.; Rickert, P.G.; Horwitz, E.P. (Argonne National Lab., IL (USA)). 1987. Contract W-31109-ENG-38. 32p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88002969/JAW.

From 5. symposium on separation science and technology for energy application; Knoxville, TN, USA (26 Oct 1987).

The hydrolytic and radiolytic degradation of octyl(phenyl)-N,N-diisobutylcarbamoylmethylphosphine oxide (CMPO) in tetrachloroethylene (TCE) and tributylphosphate-TCE mixtures (TRUEX process solvent) has been investigated. Decomposition products of CMPO have been identified and quantified by gas chromatography and GC-mass spectrometry. CMPO is more severely hydrolyzed in TRUEX process solvent than in TCE, but radiation damage appears to be slightly more severe in TCE than in TRUEX-TCE. Hydrolysis and radiolysis of CMPO produce the same degradation products in different relative yields. Acidic organo-phosphorus degradation products, which interfere with the stripping of americium, are favored to a greater degree in hydrolysis and increase with [HNO_3]. Treatment with Na_2CO_3 solution removes these acidic impurities. In radiolyzed samples destruction of CMPO is independent of [HNO_3]. Extraction of Am in radiolyzed solutions decreases little despite 40% loss of extractant. Neither hydrolysis nor radiolysis appears to significantly compromise the performance of TRUEX-TCE process solvent. 4 refs., 8 figs., 4 tabs.

4007 Radiochemistry And Nuclear Chemistry

REFER ALSO TO CITATION(S) 8478, 8512, 8557, 9192, 9517, 9552, 9553

9240 **(AERE-R—11899) Study of some actinide hydrolysis products using ultrafiltration.** Wilkins, J.D.; Wisbey, S.J. (UKAEA Atomic Energy Research Establishment, Harwell. Chemistry Div.). Nov 1985. 54p. H.M. Stationery Office, London, price Pound 5.00.

Hydrolysis products of plutonium in acid solution have been examined using commercially available ultrafiltration membranes to classify the size ranges of the species present. The tendency of hydrolysed species to give high contamination levels on surfaces has been used as a sensitive probe for small amounts of these species. A wide range of sizes of species were found in most solutions, but the presence of uranyl ion in a plutonium solution reduced the maximum size and reduced the range of sizes of "polymeric" species. Ageing reversed these trends. Very high retention filters were required to remove all the species that could lead to enhanced contamination levels on surfaces.

9241 **(AERE-R—11975) Solubility of neptunium(IV) at high pH.** Ewart, F.T.; Gore, S.J.M.; Williams, S.J. (UKAEA Atomic Energy Research Establishment, Harwell. Chemistry Div.). Oct 1985. 9p. H.M. Stationery Office, London, price Pound 4.00.

The solubility of neptunium(IV) has been measured in water which had been previously equilibriated with mature concrete. Such conditions are representative of those which may exist within a radioactive waste repository constructed of iron reinforced concrete. Neptunium-235 was used to enhance the sensitivity of the analytical technique. The solubility was found to be invariant in the pH range 10-13 with a value of 8×10^{-9} M. These data were interpreted on the basis of $Np(OH)_4$(solid) in equilibrium with $Np(OH)_4^0$(aq) with a formation constant for the reaction $Np^{4+} + 4H_2O \rightarrow Np(OH)_4H^+$ given by log K =- 9 +- 1.

9242 **(CNIC—00015) Study of adsorption equilibrium on quaternary ammonium resin in uranyl sulphate solution.** Xu Genfu; Xu Jiazhong; Zhu Jinghua. (China Nuclear Information Centre, Beijing, BJ). 1986. 11p. (In Chinese). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88700752/JAW.

Adsorption equilibrium on quaternary ammonium resin in uranyl sulphate solution, which is similar to composition used in uranium hydrometallurgy, was studied by chemical equivalent method. In the given range, the ratio of HSO/sub 4//sup -/ to SO/sub 4//sup 2-/ on the resin is dependent on concentration of H/sup +/ and ionic strength (μ) of solution, but it is independent of other anions sorbed on the resin. When the solution has μ of 0.1 to 0.5, pH of 1.5 to 1.9 and 0.5 x 10/sup -3/ to 2.0 x 10/sup -3/ M of uranium, the value of n in complex UO/sub 2/(SO/sub 4/)/sub n//sup 2-2n/ is 2.5 to 2.7. The uranium occupies about 30% to 50% of total resin capacity.

9243 **(CONF-871101—68) Californium-252 sales and loans at Oak Ridge National Laboratory.** King, L.J. (Oak Ridge National Lab., TN (USA)). 1987. Contract AC05-84OR21400. 47p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88002620/JAW.

From Joint meeting of the American Nuclear Society and the Atomic Industrial Forum; Los Angeles, CA, USA (15 Nov 1987).

The production and distribution of Californium-252 in USA has recently been consolidated at ORNL. This document consists of viewgraphs and comments. (DLC)

9244 **(CONF-871101—69) High-purity isotopes production by short-term HFIR [High-Flux Isotope Reactor] irradiations.** Knauer, J.B.; Alexander, C.W.; Bigelow, J.E.; Wiggins, J.T. (Oak Ridge National Lab., TN (USA)). 1987. Contract AC05-84OR21400. 13p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88002621/JAW.

From Joint meeting of the American Nuclear Society and the Atomic Industrial Forum; Los Angeles, CA, USA (15 Nov 1987).

The Transuranium Processing Plant (TPP) at Oak Ridge National Laboratory, along with the High-Flux Isotope Reactor (HFIR) were built to produce the quantities of the transplutonium elements needed for the heavy-element research programs of the US Department of Energy (USDOE). This document consists of viewographs and tables.

9245 **(INIS-mf—11036) Gel generator project: the prospectus of a development program in which the gel generator is assessed as a suitable source of technetium-99m in clinical nuclear medicine.** Boyd, R.E. (Australian Atomic Energy Commission Research Establishment, Lucas Heights). Feb 1987. 40p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88700430/JAW.

An overview is presented of the gel generator project based on the neutron activation of molybdenum. It operates through the simple technique of column elution, and the separated Tc-99m is not contaminated with undesirable radioactive or chemical impurities. The principles behind technetium generators are discussed, and publications and patents applying to the gel generator are listed.

9246 (INIS-mf—11048, pp 137) **Labelling of phenolrot with short-living radionuclides for the purpose of the radiodiagnostics.** Uzunov, I.; Veleva, N. Oct 1985. (In Bulgarian). NTIS (US Sales Only), PC A09/MF A01. Order Number DE88780035/JAW. (CONF-8510479—).

From 6. national congress of roentgenology, radiology and radiobiology; Sofia, Bulgaria (4 Oct 1985).

9247 (INIS-mf—11048, pp 137-138) **New conditions for labelling of 113m-indium ferric hydroxide for perfusion scintigraphy.** Pencheva, V. Oct 1985. (In Bulgarian). NTIS (US Sales Only), PC A09/MF A01. Order Number DE88780035/JAW. (CONF-8510479—).

From 6. national congress of roentgenology, radiology and radiobiology; Sofia, Bulgaria (4 Oct 1985).

9248 (INIS-mf—11048, pp 150) **Specifying the conditions for tin pyrophosphates complexes preparations.** Pencheva, V. Oct 1985. (In Bulgarian). NTIS (US Sales Only), PC A09/MF A01. Order Number DE88780035/JAW. (CONF-8510479—).

From 6. national congress of roentgenology, radiology and radiobiology; Sofia, Bulgaria (4 Oct 1985).

9249 (INIS-mf—11048, pp 171) **Obtaining of a kit HEDP for labelling with 99m-technetium.** Kovacheva-Marinova, S.; Bychvarova, K.; Isakov, I. (Meditsinska Akademiya, Sofia, Bulgaria. Nauchen Inst. po Rentgenologiya i Radiobiologiya). Oct 1985. (In Bulgarian). NTIS (US Sales Only), PC A09/MF A01. Order Number DE88780035/JAW. (CONF-8510479—).

From 6. national congress of roentgenology, radiology and radiobiology; Sofia, Bulgaria (4 Oct 1985).

9250 (JINR—12-86-560) **/sup 140/La and /sup 140/Ba extraction by thenoyltrifluoroacetone and tributylphosphate.** Korotkin, Yu.S.; Li Rak Ser. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Reactions). 1986. 7p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88700468/JAW.

The extraction of /sup 140/La and /sup 140/Ba by the thenoyltrifluoroacetone and tributyl phosphate under 0.1 mol/l and less concentration, and by their mixtures at pH=1-6 is studied. It is shown that at pH=5,2 La is extracted by TTA as a complex La(OH)/sub 2/xTTA. In the case of TTA and TBP mixture at their concentration of 10/sup -2/-10/sup -3/ mol/l the complex La(OH)/sub 2/TTA(TBP)/sub 2/ is extracted. It is shown that under high concentration of TTA and TBP the main complex La(TTA)/sub 3/(TBP)/sub 2/ is extracted. 7 refs.; 8 figs.; 1 tab.

9251 (JINR—12-86-561) **Gold extraction by some extractants and their mixtures.** Korotkin, Yu.S.; Li Rak Ser. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Reactions): 1986. 9p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88700469/JAW.

By using a number of extractants and their mixtures (HTTA + TBP; D2EHPA + HTTA; D2EHPA + TBP; TOA + TBP) the extraction of gold (+3) from solutions of hydrochloric acid is studied. It is shown that under these conditions both synergetic and antisynergetic effects take place. Inaccuracy of some published results on the extraction of gold by pure extractants is noticed. 12 refs.; 13 figs.

9252 (JINR-R—6-86-646) **Electromigration of carrier-free radioisotopes. Stability constant and mobility of La(3) complexes with oxalate and tartrate ions in aqueous solutions.** Roesch, F.; Herrmann, R.; Chan Kim Khung; Milanov, M.; Khalkin, V.A. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems). 1986. 10p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88700923/JAW.

Submitted to the journal J. Radianal. Nucl. Chem. .

Direct measurements of rates of carrier-free lanthanum-140 electromigration (T/sub 1/2/=40.3 h) were used to obtain dependences of mobility (u-bar) on concentration of two-charge ions of oxalic and tartaric acids in aqueous solution with 0.01 ionic strength and at 298.1 K. Using experimental data, concentration stability constants and individual mobilities u/sub i//sup 0/ oxalate and tatrate La(3) complexes were calculated: [La(C/sub 2/O/sub 4/)]/sup +/, [LgK/sub 1/=5.63(9), U/sup 0/=+1.95(15)x10/sup -4/ cm/sup 2/ s/sup -1/ v/sup -1/; [La(C/sub 2/O/sub 4/)/sub 2/]/sup -/, LgK/sub 2/=4.05(19), u/sup 0/=-1.76(20)x10/sup -4/ cm/sup 2/ s/sup -1/ v/sup -2/; [La(C/sub 4/H/sub 4/O/sub 6/)]/sup +/, LgK/sub 1/=4.40(5), u/sup 0/=+1.99(18)x10/sup -4/ cm/sup 2/ s/sup -1/ v/sup -1/. Obtained results were correlated with publication data. The limiting mobility of La/sup 3+/ was calculated: u/sub La(sup 3+)//sup (M=0)/=+6.9(1)x10/sup -4/ cm/sup 2/ s/sup -1/ v/sup -1/. 30 refs.; 3 figs.; 3 tabs.

9253 (JINR-R—6-86-745) **Isolation of radiothallium from proton irradiated lead by the methods of sorption from solutions on ammonium 12-molybdophosphate and gas thermochromatography.** Deptula, Ch.; Zajtseva, N.G.; Kim Sen Khan; Knotek, O.; Mikets, P.; Khalkin, V.A. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems). 1986. 14p. (In Russian). (CONF-8612113—). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88700719/JAW.

From 2. All-Union conference on analytical chemistry of radioactive elements; Moscow, USSR (2 Dec 1986).

Submitted to the journal Sov. Radioch. .

The mothods of separation of radiothallium from proton irradiated lead which permit to obtain with a high yield and good radionuclidic and radiochemical purity thallium-201 specimens for nuclear medicine are considered. They are based on the results of the study of behaviour of thallium ultramicroamounts in ion-exchange processes on the inorganic sorbents and cationites, and also in the high-temperature gas-thermochromatographic processes. 19 refs.; 10 figs.; 3 tabs.

9254 (NIIAR—5(686)) **Studies on transuranium element chemistry and chemical technology.** Nikolaev, V.M.; Timofeev, G.A.; Vasil'ev, V.Ya.; Kapshukov, I.I.; Karelin, E.A.; Kosulin, N.S. (Nauchno-Issledovatel'skij Inst. Atomnykh Reaktorov, Dimitrovgrad (USSR)). 1986. 23p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88700935/JAW.

Presented are the most important data which have been obtained as a result of studies on actinide oxidation-reduction reactions in water solutions, on the production and properties of metals, intermetallic compounds and alloys with noble metals, on chemistry and structure of the solid transuranium element complex compounds. The main stages on developing the transuranium element chemical technology are considered. The process scheme for transuranium element extraction out of the irradiated targets and the techniques for analytical surveying the above process are described. The examples are given of /sup 252/Cf practical application to various-purpose neutron sources. 20 refs.; 3 figs.; 2 tabs.

9255 (RI—187) **Mass transfer kinetics and phase interface in extraction of some actinoids and lanthanoids.** Kasimov, F.D.; Kuznetsov, G.I.; Nikolaev, V.M.; Pushlenkov, M.F.; Shchepetil'nikov, N.N. (Tsentral'nyj Nauchno-Issledovatel'skij Inst. Informatsii i Tekhniko-Ehkonomicheskikh Issledovanij po Atomnoj Nauke i Tekhnike, Moscow (USSR)). 1985. 30p. (In Russian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88700938/JAW.

Comparison of extraction rates of a number of actinoids, lanthanoids and zirconium both in extractors with fixed surface of phase contact and in those with intensified mass transfer in emulsion regime of mixing, specifically in centrifugal extractors, is performed. In spite of different extracted components and diluents, close values of specific phase interface at the same mixing intensity for system with TBP are obtained. 35 refs.; 10 tabs.

9256 **^{123}I research and production at Brookhaven National Laboratory.** Mausner, L.F.; Srivastava, S.C.; Mirzadeh, S.; Meinken, G.E.; Prach, T. (Brookhaven National Lab., Upton, NY, USA). *Applied Radiation and Isotopes;* 37: No. 8, 843-851(1986). (CONF-8509264—).

From International symposium on radiohalogens; Banff, Alberta, Canada (10 Sep 1985).

Presented at symposium in part only.

The procedures for preparing high purity ^{123}I at the Brookhaven Linac Isotope Producer using the ^{127}I(p,5n)^{123}Xe reaction on a NaI target are described. The activity is supplied in a glass ampoule with anhydrous ^{123}I deposited on the interior walls, allowing maximum flexibility in subsequent iodinations. Preliminary experience with a continuous flow target is also described. The results of

a series of measurements generally showed no detectable carrier. HPLC methods to analyze the chemical form of radioiodine and to characterize various iodinated radiopharmaceuticals have been developed. These methods provide higher sensitivity, speed and resolution than commonly used techniques.

4008 Combustion, Pyrolysis, And High-temperature Chemistry

REFER ALSO TO CITATION(S) 9014, 9164, 9198, 9199

9257 (CONF-8706236—1) Bistable cellular flames. Bayliss, A.; Matkowsky, B.; Minkoff, M. (Argonne National Lab., IL (USA); Northwestern Univ., Evanston, IL (USA). Dept. of Engineering Science and Applied Mathematics). 1987. Contract W-31109-ENG-38. 8p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88003074/JAW.

From Symposium in honor of C. C. Lin; Cambridge, MA, USA (22 Jun 1987).

We consider the problem of a flame stabilized by a point source of fuel in two dimensions. We employ the diffusional thermal model which consists of a reaction, diffusion, convection system of equations for the temperature and concentration of the limiting component of the reaction. In this model, the effect that a given fluid field has on the transport of temperature and concentration is considered, while changes in the underlying flow, due to thermal expansion, are not taken into account. The given fluid velocity field in our problem corresponds to a point source of fuel of strength $2\pi\kappa$. In addition to κ, the parameters of the problem are the non-dimensional activation energy N, the ratio σ of the unburned temperature T/sub κ/ to the burned temperature T/sub b/, and the Lewis number L which is the ratio of thermal conductivity to reactant diffusivity. The previous analysis employing κ as a bifurcation parameter, is a local analysis valid only in the neighborhood of κ/sub c/. In this paper we extend this analysis into the more fully nonlinear regime. Our numerical results show that as κ increases from κ/sub c/ the system exhibits a multistable behavior with at least two distinct stable, steady cellular solutions coexisting for the same parameter values. Each such stable solution has its own domain of attraction, so that the resultant steady solution depends on the initial conditions employed. 6 refs., 2 figs.

9258 (N—87-29432) Automated reduction of data from images and holograms. Lee, G.; Trolinger, J.D.; Yu, Y.H. (National Aeronautics and Space Administration, Moffett Field, CA (USA). Ames Research Center). May 1987. vpp. (NASA-CP—2477; A—87135; NAS—1.55:2477; CONF-8501115—). NTIS, PC A99/MF A01.

From Automated reduction of data from images and holograms; Moffett Field, CA, USA (10 Jan 1985).

Laser techniques are widely used for the diagnostics of aerodynamic flow and particle fields. The storage capability of holograms has made this technique an even more powerful. Over 60 researchers in the field of holography, particle sizing and image processing convened to discuss these topics. The research program of ten government laboratories, several universities, industry and foreign countries were presented. A number of papers on holographic interferometry with applications to fluid mechanics were given. Several papers on combustion and particle sizing, speckle velocimetry and speckle interferometry were given. A session on image processing and automated fringe data reduction techniques and the type of facilities for fringe reduction was held.

9259 (SAND—85-8233) Velocity and density measurements in a turbulent nonpremixed flame with comparison to numerical model predictions. Dibble, R.W.; Schefer, R.W.; Chen, J.Y.; Hartmann, V.; Kollmann, W. (Sandia National Labs., Livermore, CA (USA)). Aug 1987. Contract AC04-76DR00789. 154p. NTIS, PC A08/MF A01; 1; GPO Dep. Order Number DE87014695/JAW.

This paper documents and codifies a data base that consists of extensive laser-based measurements of velocity and density in a turbulent nonpremixed flame of hydrogen in air. These data were obtained in the Turbulent Combustion Tunnel Facility located at the Combustion Research Facility of Sandia National Laboratories. In these flames, the chemical reaction rates for the major species are greater than the mixing rates and, therefore, the data reported here can be used for improvement of models of turbulent mixing with large heat release without the additional complication of finite rate chemical kinetics. As an example of model improvement, comparisons of the data base with predictions of a numerical model of turbulent reacting flow are made.

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9260 (ORNL/TM—10481) Navigation planning using quadtrees. Fryxell, R.C. (Oak Ridge National Lab., TN (USA)). Nov 1987. Contract AC05-84OR21400. 36p. (CESAR—87/20). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88003706/JAW.

An algorithm is presented for planning a 2-D collision-free path for a mobile robot in an unstructured work environment. The algorithm assumes the existence of a pixel map of all or part of the environment, where each pixel is either on (implying blocked) or off (implying clear). The goal is to compute a "reasonable path" between two points in a minimal amount of time, and this is achieved through a "compressed" representation of the pixel map using a modified quadtree data structure. The algorithm has been coded in the C programming language, and the results of tests made on "realistic" indoor environments are presented. A discussion on how the environmental maps were obtained from sonar range-finder data is also included. 21 refs., 12 figs., 1 tab.

9261 Supercomputers for engineering analysis. Goudreau, G.L.; Benson, D.J.; Hallquist, J.O.; Kay, G.J.; Rosinsky, R.W.; Sackett, S.J. (Univ. of California, Lawrence Livermore National Lab., Livermore, CA). pp 117-132 of Computational mechanics: Advances and trends. Noor, A.K. New York, NY; American Society of Mechanical Engineers (1986). (CONF-861211—). Contract W-7405-ENG-48.

From American Society of Mechanical Engineers winter meeting; Anaheim, CA, USA (7 Dec 1986).

The Cray-1 and Cray X-MP/48 experience in engineering computations at the Lawrence Livermore National Laboratory is surveyed. The fully vectorized explicit DYNA and implicit NIKE finite element codes are discussed with respect to solid and structural mechanics. The main efficiencies for production analyses are currently obtained by simple CFT compiler exploitation of pipeline architecture for inner do-loop optimization. Current development of outer-loop multitasking is also discussed. Applications emphasis will be on 3D examples spanning earth penetrator loads analysis, target lethality assessment, and crashworthiness. The use of a vectorized large deformation shell element in both DYNA and NIKE has substantially expanded 3D nonlinear capability.

4202 Facilities And Equipment

REFER ALSO TO CITATION(S) 8376, 8440, 8478, 8502, 8681, 8764, 8839, 8924, 9065, 9986, 10379, 10478, 10480

9262 (AEEW-M—2277) Winfrith horizontal impact rig. Barr, P. (UKAEA Atomic Energy Establishment, Winfrith). Dec 1985. 8p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88750721/JAW.

The Horizontal Impact Rig has been designed to allow studies of the impact of radioactive material transport containers and their associated transport vehicles and impact limiters, using large scale models, and to allow physically large missiles to be projected for studying the impact behaviour of metal and concrete structures. It provides an adequately rigid support structure for impact experiments with targets of large dimensions. Details of its design, instrumentation, performance prediction and construction are given. (U.K.).

9263 (AERE-R—12154) Mixing of aerosols during in-situ filter testing. Cunningham, J.L.; Green, B.L. (UKAEA Atomic Energy Research Establishment, Harwell. Engineering Projects Div.). Mar 1986. 14p. H.M. Stationery Office, London, price Pound 4.00.

A basic requirement of in-situ testing of filter installations is that the challenge aerosol is well mixed at the filter inlet and at the downstream sampling point, thus ensuring an accurate measurement of the integrity of the filter installation. This report shows theoretically that the length of ducting required to give mixed flow is inversely proportional to the Prandtl length scale and the intensity of turbulence. Therefore by installing turbulence inducing mixing devices such as the Komax mixer, Ring and Doughnut mixer, and Stairmand disc duct lengths may be reduced; these reductions must be compared with any resulting increases in plant costs, such as increased fan capacity. Downstream of the installation under test an area sampling technique, developed at AERE Harwell, enables an accurate filter penetration to be obtained from poorly mixed flow thereby reducing the distance required between the filter and the downstream sampling point.

9264 (ANL/EES-TM—291, pp 135-140) **Mobile teleoperator remote sensing.** Hall, E.L. (Univ. of Cincinnati, OH). Feb 1986. NTIS, PC A09/MF A01. Order Number DE87013859/JAW. (CONF-8506148—).

From Workshop on requirements of mobile teleoperators for radiological emergency response and recovery; Dallas, TX, USA (23 Jun 1985).

Sensing systems are an important element of mobile teleoperators and robots. This paper discusses certain problems and limitations of vision and other sensing systems with respect to operations in a radiological accident environment. Methods which appear promising for near-term improvements to sensor technology are described. 3 refs.

9265 (BMFT-FB-T—86-179) **Chimneys and exhaust gas lines for low temperatures. Pt. 2. Testing of stacks.** Bayer, H.; Hoess, A.; Kunz, W.; Lammel, B.; Michas, D.; Schrameyer, A. (Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). Dec 1986. 460p. (In German). NTIS (US Sales Only), PC A20/MF A01. Order Number DE88750511/JAW.

The exhaust gases of fireplaces are led into the open air through chimneys. If exhaust gas temperatures are too low, moisture is secreted, which leads to penetration of moisture or sooting. Tasks set for the removal of exhaust gases having low temperatures: fundamental proposals for solutions had to be elaborated, different chimney construction types had to be tested theoretically and experimentally, the influence of secondary air had to be examined, and sample facilities had to be practically tested. With 50 refs., 156 tabs., 262 figs..

9266 (BMFT-FB-T—86-180) **Chimneys and exhaust gas lines for low temperatures. Pt. 3. Supplementary studies for verification of a heat generation unit consisting of burner, boiler, and stack. Final report.** Becht, W.; Herfort, P.; Hoess, A.; Krammer, G.; Kunz, W.; Michas, D.; Schrameyer, A. (Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). Dec 1986. 220p. (In German). NTIS (US Sales Only), PC A10/MF A01. Order Number DE88750510/JAW.

The exhaust gases of fireplaces are led into the open air through chimneys. If exhaust gas temperatures are too low, moisture is secreted, which leads to penetration of moisture or sooting. Tasks set for the removal of exhaust gases having low temperatures: Fundamental proposals for solutions had to be elaborated, different chimney construction types had to be tested theoretically and experimentally, the influence of secondary air had to be examined, and sample facilities had to be practically tested. With 17 refs., 74 tabs., 123 figs..

9267 (BMFT-FB-T—86-181) **Chimneys and exhaust gas lines for low temperatures. Pt. 4. Testing of model plants, environmental protection aspects. Final report.** Hoess, A.; Schrameyer, A. (Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). Dec 1986. 347p. (In German). NTIS (US Sales Only), PC A15/MF A01. Order Number DE88750509/JAW.

The exhaust gases of fireplaces are led into the open air through chimneys. If exhaust gas temperatures are too low, moisture is secreted, which leads to penetration of moisture or sooting. Tasks set for the removal of exhaust gases having low temperatures: Fundamental proposals for solutions had to be elaborated, different chimney construction types had to be tested theoretically and experimentally, the influence of secondary air had to be examined, and sample facilities had to be practically tested. With 3 refs., 121 tabs., 183 figs..

9268 (CONF-860778—Vol.2) **Proceedings SDIO/DARPA workshop on laser propulsion: Volume 2, Contributed papers.** Kare, J.T. (ed.). (Lawrence Livermore National Lab., CA (USA)). Apr 1987. Contract W-7405-ENG-48. 86p. NTIS, PC A05/MF A01; 1; GPO Dep. Order Number DE87011881/JAW.

From SDIO/DARPA workshop on laser propulsion; Livermore, CA, USA (7 Jul 1986).

This second volume of the Proceedings of the 1986 Workshop on Laser Propulsion, sponsored by SDIO and DARPA and held at the Lawrence Livermore National Laboratory, 7-18 July 1986, consists of papers contributed by Workshop attendees. While only a fraction of those present at the Workshop are represented here, these papers give a cross section of current ideas in the field. In particular, "Laser Thermal Propulsion" and "CW Laser Propulsion" give an overview of ongoing work on propulsion by CW lasers, while "Laser Propulsion to Earth Orbit..." presents a concept for pulsed laser propulsion that is the focus of considerable new research. "One-Dimensional Modelling of a Two-Pulse LSD Thruster" and "Trajectory Simulation for Laser Launching" describe some of this research in embryo form. Laser propulsion lends itself to some unique applications, some of which are discussed in the paper "Strategic Defense Applications of Ground-Based Laser Propulsion." "Laser Weapon Target Practice with Gee-Whiz Targets" describes a particularly spectacular application of propulsion by photon momentum. Finally, some engineering possibilities for advanced laser-propelled vehicles are described in "The 'Mercury Lightcraft' Concept." Individual papers have been cataloged separately.

9269 (CONF-860778—Vol.2, pp 1-12) **Laser propulsion to earth orbit: Has its time come?.** Kantrowitz, A. (Dartmouth College, Hanover, NH). Apr 1987. NTIS, PC A05/MF A01. Order Number DE87011881/JAW.

From SDIO/DARPA workshop on laser propulsion; Livermore, CA, USA (7 Jul 1986).

The development of thruster technology has not been vigorously pursued, and such work as has been carried out seems more adapted to the task of changing the orbit of a satellite (which needs much less laser power). The development of thruster technology for earth-to-orbit applications has not been funded, and, therefore, thruster technology remains the chief technical unknown in assessing the possible importance of laser propulsion to earth orbit. An approach to this problem is offered below. Perhaps the most important change that has occurred in recent years is the perceived need to transport thousands of tons annually to LEO. Part of this payload will be large numbers of relatively small units. A second part (e.g., fluids or other bulk materials) can be assembled in orbit. A third part is better launched in units weighing many tons. This paper assesses what is needed to realize a practical laser propulsion system for those payloads that can be launched as large numbers of relatively small units. While past experience clearly demonstrates the necessity of extreme caution in predicting the costs of space-transportation systems, we will give reasons for believing that, for some applications, such a system could be considerably cheaper than chemical rockets.

9270 (CONF-860778—Vol.2, pp 23-27) **Laser thermal propulsion.** Keefer, D. (Univ. of Tennessee Space Institute, Tullahoma). Apr 1987. NTIS, PC A05/MF A01. Order Number DE87011881/JAW.

From SDIO/DARPA workshop on laser propulsion; Livermore, CA, USA (7 Jul 1986).

This paper contains a technical discussion and research proposal to identify the physical processes that are of importance for laser sustained argon and hydrogen plasmas of large size to incorporate those processes into improved computational models. (LSP)

9271 (CONF-860778—Vol.2, pp 29-39) **CW laser propulsion.** Krier, H.; Mazumder, J. (Univ. of Illinois, Urbana). Apr 1987. NTIS, PC A05/MF A01. Order Number DE87011881/JAW.

From SDIO/DARPA workshop on laser propulsion; Livermore, CA, USA (7 Jul 1986).

Recent experimental and analytical studies at the University of Illinois and the University of Tennessee indicate that CW laser propulsion is an entirely feasible form of advanced rocket propulsion that can produce high specific impulses at high thermal efficiencies. These studies have clearly defined the physics of the CW process, have failed to uncover any serious feasibility problems, and have paved the way for additional scaling studies at higher laser powers. This report discusses the current state of the art of CW-laser propulsion research through a full description of ongoing research at the University of Illinois. It also discusses the implications of these findings and indicates the types of propulsion missions for which CW laser propulsion is best suited. Two possible designs for earth-launch CW thrusters are also presented. Finally, the additional near-term research that is needed to fully verify the feasibility of high-power CW-laser propulsion is discussed.

9272 (CONF-860778—Vol.2, pp 41-44) **Laser weapon target practice with Gee-Whiz targets.** Forward, R.L. (Hughes Research Labs., Malibu, CA). Apr 1987. NTIS, PC A05/MF A01. Order Number DE87011881/JAW.

From SDIO/DARPA workshop on laser propulsion; Livermore, CA, USA (7 Jul 1986).

It is proposed that small, lightweight, highly reflecting targets be deployed outside the atmosphere by a sounding rocket and used to test ground-based laser weapon systems. The photon pressure from the laser beam would drive the targets outward at high accelerations to reach extremely high terminal velocities - the fast objects in the solar system. The targets would test the system pointing, tracking, and focusing subsystems in a nondestructive manner that would blunt criticism of the tests. Since the light reflected by the targets could be seen from the ground, the tests would allow public viewing and participation from anywhere in the continental United States.

9273 (CONF-860778—Vol.2, pp 45-59) **Strategic defense applications of ground-based laser propulsion.** Chapman, P.K. (Space Energetics, Inc., Mountain View, CA). Apr 1987. NTIS, PC A05/MF A01. Order Number DE87011881/JAW.

From SDIO/DARPA workshop on laser propulsion; Livermore, CA, USA (7 Jul 1986).

Ground-based laser propulsion can provide a cheap means of launching small payloads to earth orbit. This technology may provide important advantages for some strategic-defense applications. Potential missions include launch of bulk cargo to an orbital facility, maintenance of satellites in very low orbits, boost-phase missile intercept, and quick-look reconnaissance.

9274 (CONF-860778—Vol.2, pp 61-77) **Trajectory simulation for laser launching.** Kare, J.T. (Lawrence Livermore National Lab., CA). Apr 1987. NTIS, PC A05/MF A01. Order Number DE87011881/JAW.

From SDIO/DARPA workshop on laser propulsion; Livermore, CA, USA (7 Jul 1986).

Laser propulsion may allow the construction of thrusters with specific impulses variable in flight from near zero to over 1000 seconds. The performance of laser-propelled vehicles launched from earth to orbit will be constrained by properties of the laser, the propagation path, and the thruster itself. The optimum trajectories for launching laser-propelled vehicles by using a ground-based laser may thus differ considerably from those for conventional rockets. We discuss how the components of a launch system affect its performance and present initial results from a trajectory simulator for such vehicles that allows us to model many features of a laser launch. With a thruster efficiency of 40%, payloads of about 1500 kg/GW of laser power can be launched from the ground to low earth orbit (LEO); high specific impulses (>800 s) may be desirable even for the early low-velocity part of the trajectory.

9275 (CONF-860778—Vol.2, pp 79-88) **One-dimensional modelling of a two-pulse LSD thruster.** Hyde, R.A. (Lawrence Livermore National Lab., CA). Apr 1987. NTIS, PC A05/MF A01. Order Number DE87011881/JAW.

From SDIO/DARPA workshop on laser propulsion; Livermore, CA, USA (7 Jul 1986).

There is no doubt that thrust can be generated by direct irradiation of a surface by a pulsed laser beam; the impulse so developed has been extensively studied as a means of destroying targets with lasers. However, while the same basic principle can be applied to rocket propulsion, the details will differ. Unfortunately, when a surface is directly irradiated by a pulsed laser, the amount of material blown off is governed by its strength and vaporization energy. This ejecta generally has too wide an energy range and too low a mean velocity for use in an efficient surface-to-orbit laser rocket. A higher and more controllable exhaust velocity can be attained by a two-step process; one first emplaces the desired amount of propellant as a gas layer above the surface, and then deposits the laser energy directly in this atmosphere. Because the amount of propellant used is no longer determined by the deposited laser energy, this method permits the exhaust velocity to be chosen separately; the less gas used, the higher its speed. To use this technique, a way is needed to emplace the gas layer, and have a strong enough absorption mechanism so that the incident laser flux deposits in the atmosphere before reaching the underlying surface. The gas layer can be formed in several ways; one option employs transpiration of a liquid through a porous plate, while another uses a laser prepulse to ablate the desired amount of gas from a solid propellant surface. This report concentrates on modelling the post-emplacement events, i.e., absorption of laser light by the gas, and its subsequent hydrodynamic motion.

9276 (EUR—10687) **Shock tubes: compressions in the low pressure chamber.** Schins, H.; Giuliani, S. (Commission of the European Communities, Ispra (Italy). Joint Research Centre; Commission of the European Communities, Luxembourg). 1986. 87p. NTIS (US Sales Only), PC A05/MF A01. Order Number DE88751584/JAW.

The gas shock tube used in these experiments consists of a low pressure chamber and a high pressure chamber, divided by a metal-diaphragm-to-rupture. In contrast to the shock mode of operation, where incident and reflected shocks in the low pressure chamber are studied which occur within 3.5 ms, in this work the compression mode of operation was studied, whose maxima occur (in the low pressure chamber) about 9 ms after rupture. Theoretical analysis was done with the finite element computer code EURDYN-1M, where the computation was carried out to 30 ms.

9277 (INIS-mf—11052, pp vp) **Cryogenic nuclear orientation of short-lived isotopes.** Grant, I.S. (Manchester Univ., UK. Schuster Lab.). 1985. NTIS (US Sales Only), PC A19/MF A01. Order Number DE88700667/JAW. (CONF-8509430—).

From International summer school on hyperfine interactions and international study meeting: physics with oriented nuclei; Bechyne, Czechoslovakia (2 Sep 1985).

An on-line cryogenic facility is described coupled with the accelerator in Daresbury which is designed for the study of the decay of oriented short-lived nuclei. The design is described and parameters given of the /sup 3/He-/sup 4/He dilution refrigerator. The facility was used to study the decay of short-lived iodine isotopes. (Z.J.).

9278 (ITEF—50-1985) **Nitrogen cryostat for Moessbauer scattering investigation.** Goryachev, V.S.; Novikov, V.M.; Romasheva, P.I. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1985. 7p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88700444/JAW.

Nitrogen cryostat for Moessbauer scattering experimental investigation is presented. Mechanical techniques without a vacuum system permitted to maintain nitrogen temperature at gamma-radiator moving in a predetermined fashion with high accuracy and for a long period. 2 refs.; 1 fig.; 1 tab.

9279 (JAERI-M—87-104) Improved method of inverse kinematics calculation for a six-link manipulator. Sasaki, Shinobu. (Japan Atomic Energy Research Inst., Tokyo). Jul 1987. 27p. (In Japanese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88751055/JAW.

As one method of solving the inverse problem related to a six-link manipulator, an improvement was made of previously proposed calculation algorithm based on a solution of an algebraic equation of the 24-th order. In this paper, the same type of a polynomial was derived in the form of the equation of 16-th order, i.e., the order reduced by 8, as compared to previous algorithm. The accuracy of solutions was identified to be much refined.

9280 (JINR—8-86-580) Vacuum casings from foam plastic for a cryogenic target. Golovanov, L.B.; Mazarskij, V.L.; Tsvinev, A.P.; Chumakov, V.F. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy). 1986. 2p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88700463/JAW.

The polystyrene foam (PS-1) for preparation of vacuum vessels of the cryogenic targets without additional covering of the surface has been used. The calculation of permeability of plastic foam by polystyrene permeability coefficient is proposed. The diffusion coefficients have been determined on the construction from plastic foam. 3 refs.; 2 tabs.

9281 (LBL—23103) Experience with measuring magnetic moments of permanent magnet blocks at Lawrence Berkeley Laboratory. Nelson, D.H.; Barale, P.J.; Green, M.I.; Van Dyke, D.A. (Lawrence Berkeley Lab., CA (USA)). Sep 1987. Contract AC03-76SF00098. 6p. (CONF-_70901—14). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88002768/JAW.

From 10. international conference on magnet technology (MT-10); Boston, MA, USA (21 Sep 1987).

Since May 1985, The Magnetic Measurements Engineering Group at LBL has measured and sorted a total of 3834 permanent magnet blocks. These magnetic blocks have been used in the construction of various successful beam-line elements including dipoles, quadrupoles, and wigglers. We report on observed variations in magnetic moments among blocks supplied by five manufacturers, describe the operational capabilities (accuracy, precision, and resolution) of the LBL Magnetic-moment Measurement and Sorting System (MMSS), cite the results of comparative calibrations by permanent-magnet manufacturers and other National Laboratories, and suggest criteria for automating the MMSS for measuring the large number of permanent-magnet blocks required for the insertion devices for the projected LBL 1-2 GeV Synchrotron Radiation Source. 14 refs., 2 figs., 2 tabs.

9282 (LBL—23975, pp 191-240) Part 3: Noise rise in Josephson Junctions. Sep 1987. NTIS, PC A12/MF A01. Order Number DE88002330/JAW.

In Studies of nonlinear and chaotic phenomena in solid state systems.

This part takes a new look at an old problem, namely the observed "noise rise" in superconducting Josephson junction parametric amplifiers. By exploiting recent insights from dynamical systems theory, it is shown how the interplay of random noise and (nonchaotic) deterministic dynamics can result in a noise rise like that observed in experiments. This analysis leads to a universal first order equation which applies to all similar systems in the high-gain regime. Several predictions are proposed which can be tested experimentally, including that a similar noise rise should occur in modulated semiconductor injection lasers. An analysis is also made of a previously unknown mode of operation - a "six-photon" mode associated with a symmetry breaking bifurcation - and its potential advantages over the previously studied three-photon and four-photon modes are discussed. 40 refs., 15 figs.

9283 (NEI-NO—36) Building engineering measures for the reduction of radon concentrations in future dwellings. (Helsedirektoratet, Oslo (Norway)). 1986. 8p. (In Norwegian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88751473/JAW.

The general principles and mechanisms how soil gas carrying radon infiltrates from the foundation bed and subsoil into buildings are described. Recommendations as to ways of reducing the radon levels indoors are given.

9284 (NUREG—0383-Vol.1-Rev.10) Directory of certificates of compliance for radioactive materials packages: Summary report of NRC approved packages. (Nuclear Regulatory Commission, Washington, DC (USA). Div. of Safeguards and Transportation). Nov 1987. 602p. NTIS, PC A99/MF A01 - GPO. Order Number TI88900243/JAW.

This directory contains a Summary Report of the US Nuclear Regulatory Commission's Approved Packages (Volume 1). This directory makes available a convenient source of information on packagings which have been approved by the US Nuclear Regulatory Commission. To assist in identifying packaging, an index by Model Number and corresponding Certificate of Compliance Number is included at the back of Volume 1.

9285 (NUREG—0383-Vol.2-Rev.10) Directory of certificates of compliance for radioactive materials packages: Certificates of compliance. (Nuclear Regulatory Commission, Washington, DC (USA). Div. of Safeguards and Transportation). Nov 1987. 652p. NTIS, PC A99/MF A01 - GPO. Order Number TI88900244/JAW.

This directory contains a Summary Report of the US Nuclear Regulatory Commission's Certificates of Compliance (Volume 2) for Radioactive Material Packages effective October 1, 1987. This directory makes available a convenient source of information on packagings which have been approved by the US Nuclear Regulatory Commission. To assist in identifying packaging, an index by Model Number and corresponding Certificate of Compliance Number is included at the back of Volume 2 of the directory. A listing by packaging types is included in the back of Volume 2.

9286 (NUREG—0383-Vol.3-Rev.7) Directory of certificates of compliance for radioactive materials packages: Summary report of NRC approved quality assurance programs for radioactive material packages. (Nuclear Regulatory Commission, Washington, DC (USA). Div. of Safeguards and Transportation). Nov 1987. 140p. NTIS, PC A07/MF A01 - GPO. Order Number TI88900245/JAW.

This directory contains a Summary Report of the US Nuclear Regulatory Commission's Summary Report of NRC Approved Quality Assurance Programs (Volume 3) for Radioactive Material Packages effective October 1, 1987. This directory makes available a convenient source of information on packagings which have been approved by the US Nuclear Regulatory Commission. To assist in identifying packaging, an alphabetical listing by Company name is included in the back of Volume 3 for approved QA programs. The Summary Reports include a listing of all users of each package design and approved QA programs prior to the publication date of the directory.

9287 (NUREG/CR—3966) Methods for impact analysis of shipping containers. Nelson, T.A.; Chun, R.C. (Lawrence Livermore National Lab., CA (USA)). Nov 1987. Contract W-7405-ENG-48. 60p. (UCID—20639). NTIS, PC A04/MF A01 - GPO. Order Number TI88002681/JAW.

This report reviews methods for performing impact stress analyses of shipping containers used to transport spent fuel. The three methods discussed are quasi-static, dynamic lumped parameter; and dynamic finite element. These methods are used by industry for performing impact analyses for Safety Analysis Reports. The approach for each method is described including assumptions and limitations and modeling considerations. The effects of uncertainties in the modeling and analyzing of casks are identified. Each of the methods uses linear elastic structural analysis principles. Methods for interfacing impact stresses with the design and load combinations criteria specified in Regulatory Guides 7.6 and 7.8 are outlined. The quasi-static method is based on D'Alembert's principle to substitute equivalent static forces for inertial forces created by the impact. The lumped parameter method is based on using a discrete number of stiffness elements and masses to represent the cask during impact. The dynamic finite element method uses finite element techniques combined with time integration to analyze the cask impact. Each of these methods can provide an acceptable

means, within certain limitations, for analyzing cask impact on unyielding surfaces. 25 refs., 23 figs.

9288 **(SAND—87-0513) TRUPACT-I over-the-road test.** Glass, R.E.; Gwinn, K.W. (Sandia National Labs., Albuquerque, NM (USA)). Oct 1987. Contract AC04-76DP00789. 82p. NTIS, PC A05/MF A01; 1; GPO Dep. Order Number DE88003243/JAW.

The TRUPACT-I was subjected to an over-the-road test to determine the package response to normal road environments. This test consisted of six road events: a rough primary road, a railroad grade crossing, an asphalt primary road, a concrete primary road, a bridge approach, and a rough secondary road. The package was instrumented with four vertical accelerometers to determine the package response to road vibration and shock. The results are given in the form of time histories, spectral densities, root mean square, and maximum accelerations for all accelerometers during each event. The results indicated that the railroad grade crossing produced the maximum average vertical accelerations. The maximum accelerations for all events were less than 1 g, and the root mean square loads remained below 0.25 g. 4 refs., 57 figs., 7 tabs.

9289 **(SAND—87-2561C) Earth penetrator strain gage applications.** May, R.A.; Dorrell, L.R. (Sandia National Labs., Albuquerque, NM (USA)). 1987. Contract AC04-76DP00789. 9p. (CONF-871184—1). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88002260/JAW.

From IMOG Fall meeting; Kansas City, MO, USA (3 Nov 1987).

During earth entry of high speed projectiles large, time-dependent forces are applied to the structure. In order to accurately model the response of these penetrators using both finite element methods and lumped mass-spring models, this force-time relationship must be quantified and used as an input for the analytical models. Two earth penetrators were internally strain gaged to obtain strains in the penetrator body which could be used to calculate the applied forces. The installation techniques used to install the gages 0.46 m (18 in.) from the end of the 127 mm (5 in.) inside diameter penetrator case are presented. Gage and adhesive selection as well as wiring and data acquisition techniques designed to survive the high inertial loads encountered during earth entry are discussed and preliminary results from the first test are shown. 4 refs., 6 figs.

9290 **(UCRL—97118) Sputtered-sliced linear zone plates for 8 keV x rays.** Bionta, R.M.; Jankowski, A.F.; Makowiecki, D.M. (Lawrence Livermore National Lab., CA (USA)). 19 Oct 1987. Contract W-7405-ENG-48. 5p. (CONF-8708180—2). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88002468/JAW.

From Symposium on X-ray microscopy; Brookhaven, NY, USA (31 Aug 1987).

We describe the fabrication and testing of sputtered-sliced linear zone plates, designed to focus 8 keV ($\lambda = 1.54$ A) x-ray photons from conventional Cu x-ray sources. 2 refs., 5 figs.

9291 **(UCRL—97322) Solution of the time-harmonic semi-Maxwell equations for induction heating using FIDAP.** Gresho, P.M.; Derby, J.J. (Lawrence Livermore National Lab., CA (USA)). Nov 1987. Contract W-7405-ENG-48. 71p. (CONF-871007—59). NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE88002664/JAW.

From 12. symposium on fusion engineering; Monterey, CA, USA (12 Oct 1987).

After summarizing the development of a model that describes the induction heating process in axisymmetric geometries and the implementation of the model in the FIDAP code, it is applied to a particular process that is being used at the Lawrence Livermore National Laboratory in conjunction with advanced crystal growth technology for the laser program. 11 refs., 43 figs., 1 tab.

4203 Lasers

REFER ALSO TO CITATION(S) 9268, 9269, 9270, 9272, 9274, 9348, 10590

9292 **(ATES/DMA/SSD/154—86-REV-1) High power laser source for space applications. Phase 1 study. Executive summary. Final report.** (Alcatel Thomson Espace, Courbevoie (France)). Jul 1986. 9p. (ESA-CR(P)—2369; ETN—87-90472). NTIS, PC A02/MF A01.

A study to design a high power laser diode, to manufacture samples, to test them, and to identify the problems raised by the manufacture of such power sources in order to evaluate the effort required to overcome the difficulties in view of a component qualification was initiated. Theoretical modeling, manufacturing and test of samples, and environmental evaluation were completed. To obtain 200 mW monomode, a reversed CSP structure manufactured by chemical vapor deposition is recommended.

9293 **(LA-UR—87-2728) Induced turbulence in aerosol-loaded atmospheres.** Chitanvis, S.M. (Los Alamos National Lab., NM (USA)). 7 Aug 1987. Contract W-7405-ENG-36. 16p. (CONF-8706199—2). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE87014724/JAW.

From CRDEC scientific conference on obscuration and aerosol research; Aberdeen, MD, USA (1 Jun 1987).

This paper considers the effects of a pulse of radiation from a high-energy laser beam on the ambient turbulence that exists in the atmosphere. The atmosphere is considered as a compressible, perfect gas being heated by the high-energy laser pulse. We compute correlation functions of the temperature in the isobaric regime. The two-point correlation function is changed by a multiplicative factor that grows exponentially in time while the pulse is on Empirical formulas permit us to connect temperature fluctuations that we can compute to the refractive index fluctuations of the atmosphere. These self-induced refractive index fluctuations will be useful in studying the propagation characteristics of high energy laser beams through the atmosphere. 9 refs.

9294 **(LA-UR—87-3929) Mode media interactions in an FEL (Free Electron Laser).** Gitomer, S.J.; Bender, S.C.; McVey, B.D. (Los Alamos National Lab., NM (USA)). 1987. Contract W-7405-ENG-36. 37p. (CONF-8709110—12). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88003155/JAW.

From 9. international free-electron laser conference; Williamsburg, VA, USA (14 Sep 1987).

It is well known that the e-beam gain and refractive properties in an FEL alters the optical mode behavior from that of a bare resonator. We report here on 3-D simulations with FELEX and experiments on the 10.6 micron wavelength Los Alamos FEL performed to assess the importance of this effect for a range of e-beam parameters. Two sets of measurements are made for a near concentric cavity with optical axis displaced from the electron beam axis. The first is a static measurement made during cavity mode saturation of the optical beam centroid referred to each resonator mirror. The optical detector scheme for this part of the experiment uses a 256 element integrating pyroelectric array. The second is a dynamic measurement made during cavity mode decay of the motion of the optical beam centroid and waist referred to each resonator mirror. The optical detection scheme for this part of the experiment consists of a three-part split mirror detector viewing two different optical paths. These measurements quantify the gain and refractive properties of the electron beam when compared to FELEX simulations. Implications for FEL alignment schemes and future high-power FELs will be discussed. 6 figs., 1 tab.

9295 **(N—87-29820) Direct solar-pumped iodine laser amplifier. Semiannual progress report, 1 March-30 September 1987.** Han, K.S. (Hampton Inst., VA (USA)). Oct 1987. 43p. (NASA-CR—181391; NAS—1.26:181391). NTIS, PC A03/MF A01.

This semiannual progress report covers the period from March 1, 1987 to September 30, 1987 under NASA grant NAG1-441 entitled Direct solar-pumped iodine laser amplifier. During this period Nd:YAG and Nd:Cr:GSGG crystals have been tested for

the solar-simulator pumped cw laser, and loss mechanisms of the laser output power in a flashlamp-pumped iodine laser also have been identified theoretically. It was observed that the threshold pump-beam intensities for both Nd:YAG and Nd:Cr:GSGG crystals were about 1000 solar constants, and the cw laser operation of the Nd:Cr:GSGG crystal was more difficult than that of the Nd:YAG crystal under the solar-simulator pumping. The possibility of the Nd:Cr:GSGG laser operation with a fast continuously chopped pumping was also observed. In addition, good agreement between the theoretical calculations and the experimental data on the loss mechanisms of a flashlamp-pumped iodine laser at various fill pressures and various lasants was achieved.

9296 **(STC—52220/86/0048/ES/ARG) High power semiconductor laser source for space applications. Executive summary.** Goodwin, A.R.; Whiteaway, J.E.A.; Collar, A.J. (Standard Telephones and Cables Ltd., London (UK)). Jul 1986. 10p. (ESA-CR(P)—2371; ETN—87-90474). NTIS, PC A02/MF A01.

Semiconductor laser sources for optical communication links between geostationary and low Earth orbiting satellites were investigated. Phase locked arrays of coupled stripes or related devices offer single mode operation at much lower optical and current density than other techniques. The highest powers are expected using GaAlAs, the best reliability using InGaAsP. Use of very thin highly doped p-InP buffer layers in planar growth, wide mesas, long cavities, and facet coating for DCPBH lasers are suggested. Continuous output power values up to 340 mW can be generated by unoptimized multimode InGaAsP lasers emitting at 1.3 microns. It should be possible to generate continuous power levels greater than 1000 mW by optimizing facet reflectivity and thermal impedance. The Y-coupled array is the most promising concept. The addition of flared output guides, and the positioning of the couplers close to the facet with the larger number of emitters, should improve performance.

9297 **(UCRL—95623-Rev.1) Intrinsic corrections to optical guiding in a free-electron laser: Beam Research Program.** Chen, Yu-Jiuan, Scharlemann, E.T.; Sessler, A.M. (Lawrence Livermore National Lab., CA (USA); Lawrence Berkeley Lab., CA (USA)). 1987. Contract W-7405-ENG-48. 17p. (CONF-8709110—14-Rev.1). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88002667/JAW.

From 9. international free-electron laser conference; Williamsburg, VA, USA (14 Sep 1987).

The effect on optical guiding of the undulations of an electron beam in an FEL is investigated, and a model for a fully saturated FEL amplifier with no remaining gain is developed. The density of the electron beam in the model fully includes the effects of both transverse and longitudinal undulation of the beam. The longitudinal density modulation is expressed in terms of the Bessel functions of zeta, where zeta = a/sub w/^{2}/2(1 + a/sub w/^{2}) is the shift of the electron phase in the electron bucket caused by its longitudinal undulation. The transverse density modulation is evaluated to second order in the ratio of undulation amplitude δr to beam radial scale length r/sub b/. The radiation field from the modeled beam is calculated in terms of spatial modes proportional to exp[i(k + δk + lk/sub w/)z - iwt], where l is an arbitrary integer. Here, δk is the change of the wavenumber of the radiation caused by the electron bunches. Radially radiating modes with intensity on the order of (δk/k/sub w/)zeta^2 are found. Optical guiding is found to be modified by the transverse undulations of the beam at second order in δr/r/sub b/, and by the longitudinal undulations to first order in δk/k/sub w/. For the usual FEL parameters, the correction is quite small. 15 refs., 5 figs.

9298 **(UCRL—97629) Lawrence Livermore National Laboratory soft x-ray laser program.** Trebes, J.; Brown, S.; Campbell, E.M.; Ceglio, N.; Eder, D.; Gaines, D.; Hawryluk, A.; Keane, C.; London, R.; MacGowan, B. (Lawrence Livermore National Lab., CA (USA)). Sep 1987. Contract W-7405-ENG-48. 14p. (CONF-8708180—1). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88002580/JAW.

From Symposium on X-ray microscopy; Brookhaven, NY, USA (31 Aug 1987).

The Laboratory soft x-ray laser program at the Lawrence Livermore National Laboratory's Nova laser facility has been pursuing soft x-ray laser research with the goal of developing x-ray laser physics and the necessary technology for producing usable x-ray lasers. For the microscopy community, this means developing short wavelength (λ < 44 A), high power (10^8 W), highly coherent lasers to be used in microscopy and holography applications. Significant progress toward this goal has been achieved. A variety of x-ray lasers based on the collisional pumped Ne-like laser scheme have been developed and characterized in great detail. A new collisionally pumped laser utilizing Ni-like ions has been demonstrated with laser wavelengths as short as 50 A. This new scheme is scalable to sub 44 A wavelengths. Preliminary ionization balance experiments have also begun for recombination pumped lasers which should also readily scale to sub 44 A wavelengths. A laser cavity has been developed and demonstrated using multi-layer x-ray mirrors and beam-splitters. This offers the possibility of improved laser coherence and efficiency. An applications beamline was constructed and used in a photoionization physics experiment in conjunction with Bell Laboratory. This was an important demonstration of the ability to make existing x-ray lasers usable and available for the general science community. Finally, x-ray holography using an x-ray laser has been demonstrated. 16 refs., 4 figs.

9299 **Stimulated rotational Raman scattering experiments using the LLNL Nova laser.** Pennington, D.M.; Swift, C.D.; Henesian, M.A.; Murray, J.R. (Lawrence Livermore National Lab., P.O. Box 5508, Livermore, CA 94550). pp 186 of Proceedings of the conference on lasers and electro-optics. Piscataway, NJ; IEEE Service Center (1987). (CONF-870401—).

From OSA/IEEE conference on lasers and electro-optics (CLEO '87); Baltimore, MD, USA (27 Apr 1987).

Technical Paper WM4.

The authors performed preliminary experiments at the LLNL Nova laser facility to determine the far-field intensity distribution of large-aperture beams undergoing SRRS and the threshold intensities at which scattering begins. A linearly polarized 74-cm diam beam from the Nova laser at the 1053-nm wavelength was downcollimated to 25 cm and propagated 97 m in air. Experiments were conducted with square temporal pulses at three pulse lengths, and they measured Stokes and anti-Stokes spectra, temporal pulse shape, and near- and far-field beam characteristics at the end of the propagation path. The authors observed the fist Stokes components of SRRS in air at an intensity length (IL) product of 14.2 +- 1.7 X 10/sup 12/ W/cm at 2 ns, 15.8 +- 1.8 X 10/sup 12/ W/cm at 1 ns, and >24 X 10/sup 12/ W/cm at 600 ps. The increase of the IL product at threshold for short pulses is consistent with early measurements and literature models for transient gain scaling.

9300 **Gain dynamics in high-brightness KrF lasers.** Taylor, A.J.; Roberts, J.P.; Gibson, R.B. (Los Alamos National Lab., P.O. Box 1663, Los Alamos, NM 87545). pp 212 of Proceedings of the conference on lasers and electro-optics. Piscataway, NJ; IEEE Service Center (1987). (CONF-870401—).

From OSA/IEEE conference on lasers and electro-optics (CLEO '87); Baltimore, MD, USA (27 Apr 1987).

Technical Paper THB3.

The interaction of intense radiation fields with matter is investigated using a laser system which produces focal spot intensities of >10/sup 17/ W cm/sup -2/. The system consists of a front end that generates —1-ps pulses at 248 nm and two KrF amplifiers, yielding near-diffraction-limited 15-mJ pulses. The picosecond gain dynamics of the second KrF amplifier are characterized via measurements of large- and small-signal gain and gain recovery time. This paper presents the laser system, and measures the gain recovery time.

9301 **Picosecond pulse generation in a XeCl oscillator.** Sze, R.C.; Shay, T.M.; Maloney, M.; Figueira, J. (Los Alamos National Lab., P.O. Box 1663, Los Alamos, NM 87545). pp 212 of Proceedings of the conference on lasers and electro-optics. Piscataway, NJ; IEEE Service Center (1987). (CONF-870401—).

From OSA/IEEE conference on lasers and electro-optics (CLEO '87); Baltimore, MD, USA (27 Apr 1987).

Technical Paper THB2.

Successful mode locking of a small inductively stabilized XeCl laser is accomplished using an intracavity acoustooptic mode locker. Crystalline quartz is used for the modulation medium; thus, the technique should be applicable for all rare gas halide excimer wavelengths. The laser used in this work has a gain length of 30 cm, a cavity length of 48 cm, produces a pulse train which lasts for 90 ns and a pulse-to-be-pulse separation of 3.2n. The minimum pulse duration is 120 ps FWHM, the shortest duration believed reported. Measurements of pulse duration vs time are presented. The results of short-pulse amplification experiments are presented also.

9302 **Frequency locking of a GaAlAs diode laser to the Rb(D/sub 2/) transition.** Shay, T.M.; Dobbins, J.D.; Chung, Y.C. (Los Alamos National Lab., P.O. Box 1663, Los Alamos, NM 87545). pp 236 of Proceedings of the conference on lasers and electro-optics. Piscataway, NJ; IEEE Service Center (1987). (CONF-870401—).

From OSA/IEEE conference on lasers and electro-optics (CLEO '87); Baltimore, MD, USA (27 Apr 1987).

Technical Paper THI4.

Frequency-stabilized semiconductor lasers are practical sources for a wide variety of potential applications including remote sensing, laser spectroscopy, optical frequency standards, coherent optical communication, coherent optical sensors. Solitary semiconductor lasers are essentially impervious to acoustical and mechanical disturbances since they have no external optics. On the other hand, the operating frequency for a semiconductor laser is very sensitive to temperature and current variations. Therefore, standard diode laser systems have very poor frequency stability. Thus the first step in frequency stabilizing a diode laser consists of stabilizing the temperature and injection current of the laser. The authors report a frequency-stabilized semiconductor laser with nearly quantum-noise-limited-frequency stability for time periods of 1 h.

9303 **Uses of elastooptically tuned diode laser-excited monolithic Nd:YAG lasers.** Owyoung, A.; Esherick, P. (Sandia National Labs., Albuquerque, NM 87185-5800). pp 188 of Proceedings of the conference on lasers and electro-optics. Piscataway, NJ; IEEE Service Center (1987). (CONF-870401—).

From OSA/IEEE conference on lasers and electro-optics (CLEO '87); Baltimore, MD, USA (27 Apr 1987).

Technical Paper WN1.

The authors report a method for the frequency tuning of a monolithic diode-laser-excited solid-state laser based on the inherent elastic and elastooptic properties of the laser crystal. To date, the authors have demonstrated reproducible spectral tuning of the device over a frequency range of >1 GHz at rates in excess of 1 THz/s. The dual-frequency operation suggests several possible applications in areas such as microwave frequency synthesis and optical heterodyne detection. Additional applications of the elastooptically scanned resonator can be found in the injection seeding of large solid-state laser systems.

9304 **Ionic formation channel enhancement in KrF discharge lasers.** Alexander, R.F.; Burrows, M.D. (Los Alamos National Lab., P.O. Box 1663, Los Alamos, NM 87545). pp 202-204 of Proceedings of the conference on lasers and electro-optics. Piscataway, NJ; IEEE Service Center (1987). (CONF-870401—).

From OSA/IEEE conference on lasers and electro-optics (CLEO '87); Baltimore, MD, USA (27 Apr 1987).

Technical Paper WR3.

The authors have observed that the passage of 8-10-ns tripled and quadrupled Nd:YAG pulses through a KrF discharge amplifier burns large holes in the temporal profile of the 248-nm fluorescence. The KrF* neutral formation channels in discharge-pumped lasers can be converted to ionic formation channels. To investigate this potential excimer absorption mechanism, the authors used the 157-nm photodissociation of XeF/sub 2/ as an XeF*(B,v' $>$ 0) source and a second tunable UV probe laser to investigate XeF* absorption in the 240-255-nm region. The results of these experiments are also discussed.

9305 **Kinetic processes in optically pumped Kr/sub 2/F*.** Mc Cown, A.W.; Godard, J.A.B. (Los Alamos National Lab., P.O. Box 1663, Los Alamos, NM 87545). pp 204 of Proceedings of the conference on lasers and electro-optics. Piscataway, NJ; IEEE Service Center (1987). (CONF-870401—).

From OSA/IEEE conference on lasers and electro-optics (CLEO '87); Baltimore, MD, USA (27 Apr 1987).

Technical Paper WR6.

Optical pumping of rare gas-halogen mixtures is a controlled means of preparing specific excited species that can be studied in an environment free of competitor species. In the experiments the intensities of an ArF and KrF lasers were adjusted until the KrF C→A fluorescence emanating from the cell was the same in each case. In all cases the ArF-pumped Kr/sub 2/F* density was much larger than the KrF-pumped density, indicating that the KrF excimer is not the major precursor to the Kr/sub 2/F*. Results are presented.

9306 **Progress in pulsed power discharge driven x-ray laser research.** Matzen, M.K.; Dukart, R.J.; Hammel, B.A.; Hanson, D.L.; Hsing, W.W.; Hussey, T.W.; McGuire, E.J.; Palmer, M.A.; Spielman, R.B. (Sandia National Labs., Albuquerque, NM 87185). pp 61-66 of Multilayer structures and laboratory x-ray laser research. Ceglio, N.M.; Dhez, P. Bellingham, WA; Society of Photo-Optical Instrumentation Engineers (1986). (CONF-860880—). Contract AC04-76DP00789.

From 30. SPIE technical symposium on optics and optoelectronic engineering; San Diego, CA, USA (17 Aug 1986).

In experiments performed during the past two years on Proto II (a 10-TW pulsed-power accelerator), the authors imploded annular plasmas onto thin-walled annular x-ray laser targets in order to create both a radiation pump source and an x-ray laser medium. For x-ray lasing the z-pinch must be axially uniform, must efficiently produce the pump radiation, yet not destroy the laser medium on the cylindrical axis of symmetry until after the x-ray laser pulse. To characterize the pump source x-rays and lasant conditions, they regularly field a pump radiation of x-ray diagnostics. In recent experiments, they produced over 15 kJ of $\geq$1-keV pump radiation with an imploding neon gas-puff load, recorded spectra from the pump source and lasant, and measured the axial pump source asymmetry. They are considering both recombination and resonance-pumped x-ray laser schemes.

4204 Heat Transfer And Fluid Flow

REFER ALSO TO CITATION(S) 8433, 8440, 8787, 8803, 8832, 8884, 9066, 9258

9307 **(AEEW-R—1989) Effect of fluid properties on dryout in boiling particle beds.** Macbeth, R.V.; Trenberth, R. (UKAEA Atomic Energy Establishment, Winfrith). Feb 1986. 22p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88750719/JAW.

Dryout power measurements are presented for particle beds with water boiling at pressures from 1 to 9 bar. Results were analysed for change of fluid properties with respect to pressure variation. Data for other fluids, Freon-113 and Flutec-PP9 are given, to extend the fluid property range. Analysis shows that dryout in deep beds with particles greater than 1 mm diameter can be represented by two dimensionless groups, and these are shown to provide a good correlation of the data, which indicate that for water, the dryout power peaks at about 90 bar. (U.K.).

9308 **(AEEW-R—2024) Flooding phenomenon and its connection with dry-out in boiling particle beds.** Macbeth, R.V.; Anderson, A.R. (UKAEA Atomic Energy Establishment, Winfrith). Mar 1986. 11p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88750720/JAW.

Experimental studies of boiling in particle beds representing reactor core debris have been restricted to very small beds compared with those that may be found in a reactor. The use of air and water to simulate some of the many features of boiling in a particle bed has given results that were inconclusive. The work reported

here is that carried out at Winfrith to extend the dryout data to larger particle diameters, and to provide new experimental data which removes earlier doubts, and makes the air-water analogue position much clearer. (U.K.).

9309 **(ANL—87-28) A review of two-phase flow-induced vibration.** Chen, S.S. (Argonne National Lab., IL (USA)). Aug 1987. Contract W-31109-ENG-38. 54p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE88001955/JAW.

Two-phase flow exists in many shell-and-tube heat exchangers and power generation components. The flowing fluid is a source of energy that can induce small-amplitude subcritical oscillations and large-amplitude dynamic instabilities. In fact, many practical system components have experienced excessive flow-induced vibrations. To prevent unacceptable flow-induced vibration, we must understand excitation mechanisms, develop analytical and experimental techniques, and provide reliable design guidelines. Thus, we are conducting a comprehensive program to study structural vibration in components subjected to two-phase flow. This report reviews the current understanding of vibration of circular cylinders in quiescent fluid, crossflow, and axial flow, with emphasis on excitation mechanisms, mathematical models, and available experimental data. A unified theory is presented for cylinders oscillating under different flow conditions. Based on the theory, future research needs are outlined. 57 refs., 13 figs., 1 tab.

9310 **(FEI—1681) To the problem of determining true volume steam content by measured values of mean density of a mixture in thermally unsteady two-phase flows.** Boltenko, Eh.A.; Kornienko, Yu.N.; Kochetkova, S.N.; Smirnov, Yu.A. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk. Fiziko-Ehnergeticheskij Inst.). 1985. 20p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88700840/JAW.

On the basis of experimental data on distribution of void fraction and liquid temperature in a tube in thermally non-equilibrium two-phase flow analysis of possible errors of determining void fraction by contactless methods (γ-radiation moderated neutron method) is carried out. Correct determination of true volume steam content in these cases is shown to require additional information on the profile of liquid temperature along the channel cross section. 8 refs.; 6 figs.

9311 **(FEI—1818) Experimental and numerical study of liquid distribution in dispersive-annular flow.** Kashcheev, V.M.; Muranov, Yu.V.; Shumskij, R.V.; Shtejn, Yu.Yu.; Yur'ev, Yu.S. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk. Fiziko-Ehnergeticheskij Inst.). 1986. 15p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88700844/JAW.

Results of experimental and numerical investigation into liquid phase distribution in dispersive-annular flow at 6.86 MPa pressure, 500-1500 kg/m/sup 2/ x s flow rate and 0.4, 0.5 MW/m/sup 2/ specific heat flux are presented. It is ascertained that as the flow dispersive - annular regime is being developed, droplet concentration maximum is formed in the near wall zone of a channel. Its position and value depend on the regime parameters. Effect of diffusion, convection, mass sources on the distribution curve character is numerically studied. 10 refs.; 7 figs.

9312 **(KFK—4284) On the derivation of thermodynamic restrictions for materials with internal state variables.** Malmberg, T. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Reaktorentwicklung). Jul 1987. 71p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE88751529/JAW.

Thermodynamic restrictions for the constitutive relations of an internal variable model are derived by evaluating the Clausius-Duhem entropy inequality with two different approaches. The classical Coleman-Noll argumentation of Rational Thermodynamics applied by Coleman and Gurtin to an internal variable model is summarized. This approach requires an arbitrary modulation of body forces and heat supply in the interior of the body which is subject to criticism. The second approach applied in this presentation is patterned after a concept of Mueller and Liu, originally developed within the context of a different entropy inequality and different classes of constitutive models. For the internal variable model the second approach requires only the modulation of initial values on the boundary of the body. In the course of the development of the second approach certain differences to the argumentation of Mueller and Liu become evident and are pointed out. Finally, the results demonstrate that the first and second approach give the same thermodynamic restrictions for the internal variable model. The derived residual entropy inequality requires further analysis.

9313 **(N—87-29214) Lectures series in computational fluid dynamics.** Thompson, K.W. (National Aeronautics and Space Administration, Moffett Field, CA (USA). Ames Research Center). Aug 1987. 110p. (NASA-TM—100010; A—87291; NAS—1.15:100010; CONF-8607353—). NTIS, PC A06/MF A01.

From Lectures series in computational fluid dynamics; Moffett Field, CA, USA (1 Jul 1986).

The lecture notes cover the basic principles of computational fluid dynamics (CFD). They are oriented more toward practical applications than theory, and are intended to serve as a unified source for basic material in the CFD field as well as an introduction to more specialized topics in artificial viscosity and boundary conditions. Each chapter in the text is associated with a videotaped lecture. The basic properties of conservation laws, wave equations, and shock waves are described. The duality of the conservation law and wave representations is investigated, and shock waves are examined in some detail. Finite difference techniques are introduced for the solution of wave equations and conservation laws. Stability analysis for finite difference approximations are presented. A consistent description of artificial viscosity methods are provided. Finally, the problem of nonreflecting boundary conditions are treated.

9314 **(SFB—210-T-26) Examination on three common differencing schemes for convection applied to unsteady flow problems.** Adams, E.W. (Karlsruhe Univ. (T.H.) (Germany, F.R.). Sonderforschungsbereich 210 Stroemungsmechanische Bemessungsgrundlagen fuer Bauwerke). Jan 1987. 35p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88750507/JAW.

The time-dependent dye-concentration field in a model sewage settling basin has been computed using three different numerical approximation schemes, but the same computational grid and turbulent viscosity field. The results indicate that the explicit, third order accurate in time, QUICKEST scheme of Leonard (1979) gave accurate results at lower total computation times than using either the HYBRID or the QUICK scheme for the convection terms when these latter methods are implemented using second order accurate (implicit) ADI time differencing method. Using this example problem, the paper points out the relative merits of explicit time differencing and illustrates when they can be superior to implicit schemes.

9315 **(SFB—210-T-28) Adding buoyancy EFFECTS and particle settling to VEST and TEACH. Pt. 1. Program verification and sample results.** Adams, E.W. (Karlsruhe Univ. (T.H.) (Germany, F.R.). Sonderforschungsbereich 210 Stroemungsmechanische Bemessungsgrundlagen fuer Bauwerke). Feb 1987. 41p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88750508/JAW.

This report details the necessary changes made to two computer programs, TEACH and VEST, to simulate the effects of buoyancy forces and particle settling. The report describes the mathematical models used including the approximations made and their limitations. Emphasis is given to a detailed treatment of their implementation especially to the implementation of the boundary conditions for particle settling. Example calculations are presented to verify the correctness of the changes and to illustrate the effects of buoyancy and particle settling.

9316 **(TUM-LSM—83/17) Performance comparison of different computer devices with a code for simulation of three-dimensional convective flow taking into account the CRAY-1 compiler.** Baetke, F. (Technische Univ. Muenchen (Germany, F.R.). Lehrstuhl fuer Stroemungsmechanik). Jul 1983. 64p. (In German). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88750506/JAW.

The central processor performance and the size of the main memory of large modern computers with scalar arithmetic has made the simulation of laminar, three dimensional, frictional flows possible by numerical solution of the Navier-Stokes equations with computing times of the order of several hours. A considerable reduction of these times can be achieved on so-called vector computers, if the capacity of the central processor is used by suitable programming. This report discusses the construction of CRAY-1 and the resulting programming criteria, where the special problems of vector processing are to the fore. After a survey of the basic physical equations, the numerical solving process and the build-up of the program, the step by step modification of the initial version in the direction of as great a degree of vectorisation as possible is described in detail and finally, the capacity of the fully vectorisable program version ABOX 7V, depending on the various parameters.

9317 **Concurrent multifrontal methods: Shared memory, cache, and frontwidth issues.** Benner, R.E.; Montry, G.R.; Weigand, G.G.; Duff, I. (Sandia National Labs., Albuquerque, NM 87185). *International Journal of Supercomputer Application;* **1**: No. 3, 26-44(1987).

Frontal methods are an efficient and popular means of Gauss elimination of matrix equations that arise in finite element analysis. Nested dissection of a computational domain makes possible high-level parallelism in a widely used frontal algorithm for unsymmetric systems. A concurrent, highly vectorized, multifrontal, finite element analysis of axisymmetric liquid drop oscillations with 2,210 equations runs on the CRAY X-MP/48 with factors of 1.9 and 2.9 reduction in elapsed time on two and four processors, respectively. On an ELXSI 6400 (which has an additional memory level, local processor cache, ignored in the algorithm's design for the CRAY), implementation of the same problem initially achieved a speedup of only 1.4 on four processors. Modification of the concurrent algorithm, to take advantage of the cache and frontwidth reduction by element reordering, doubled the concurrent speedup on the ELXSI to 2.8 on four processors.

9318 **Heat transfer correlations for low Reynolds number flows of water in vertical annuli.** El-Genk, M.S.; Rao, D.V. New York, NY; American Society of Mechanical Engineers (1987). 8p. (CONF-861211—). American Society of Mechanical Engineers, 345 East 47 St., New York, NY 10017.

From American Society of Mechanical Engineers winter meeting; Anaheim, CA, USA (7 Dec 1986).

Technical Paper 86-WA/HT-65.

This paper presents heat transfer correlations for both buoyancy assisted and opposed laminar and transition flows of water in vertical annuli for Reynolds numbers ranging from 150 to 10/sup 4/ and Rayleigh numbers up to 10/sup 7/. The correlations are based on more than 800 data points collected for two annuli (diameter ratio of 1.17 and 2.0) with an isoflux inner wall and an adiabatic outer wall. Results demonstrated that the buoyancy assisted flow data could be divided into four regimes based on the values of Reynolds number: Laminar ($Re < 800$), Combined Laminar ($800 < Re > 2100$), Laminar/ Transition ($2100 < Re < 5000$), and Transition ($5000 < Re$ 10,000). This data, except for transition flow, was correlated in terms of Gz to account for the effect on the Nusselt number of the axial distance from the bottom of the heated section. For buoyancy opposed flow, however, Richardson number more accurately classified the data. The data for this flow was correlated in three regions: $Ri < 0.06$, $0.06 < Ri < 0.47$, and $0.47 < Ri < 3.0$. The heat transfer correlations for both buoyancy assisted and opposed flows were within +-10 percent of the experimental data.

9319 **Condensation heat transfer in plate heat exchangers.** Panchal, C.B. (Argonne National Lab., Argonne, IL). pp 45-52 of Two phase heat exchanger symposium. Pearson, J.T.; Kitto, J.B. New York, NY; American Society of Mechanical Engineers (1985). (CONF-850810—).

From 23. national heat transfer conference; Denver, CO, USA (4 Aug 1985).

An Alfa-Laval plate heat exchanger, previously tested as an evaporator, was retested as a condenser. Two series of tests with different chevron-angle plates were carried out using ammonia as a working fluid. The overall heat-transfer coefficient and pressure drop were measured, and the effects of operating parameters were determined. The experimental data were compared with theoretical predictions. In the analysis, a gravity-controlled condensation process was modeled theoretically, and the overall performance was calculated. The analysis shows that the overall heat-transfer coefficient can be predicted with an average uncertainty of about 10%. It is, however, important to consider the interfacial shear stress, because the effective friction factor is high for flow in plate heat exchangers.

4205 Materials Testing

REFER ALSO TO CITATION(S) 8383, 8535, 9077, 9083, 9089, 9097, 9339, 9376

9320 **(AERE-R—12010) Potential use of transmission tomographic techniques for the quality checking of cemented waste drums. Progress report to 31 March 1985.** Huddleston, J.; Hutchinson, I.G. (UKAEA Atomic Energy Research Establishment, Harwell. Instrumentation and Applied Physics Div.). Jan 1986. 19p. (ILWRP—85-P24). H.M. Stationery Office, London, price Pound 4.00.

In support of the programme for the quality checking of encapsulated intermediate level waste, the possibilities of using transmission tomographic techniques for the determination of the physical properties of the drum are being considered. A literature survey has been undertaken and the possibilities of extracting data from video recordings of real time radiographs are considered. This work was carried out with financial support from British Nuclear Fuels plc and the UK Department of the Environment. In the DoE context, the results will be used in the formulation of Government Policy, but at this stage they do not necessarily represent Government Policy.

9321 **(CONF-8704231—1) A comparison of film-based tomography and computed tomography for advanced ceramic materials.** Ellingson, W.A.; Vannier, M.W.; Kriz, R.J. (Argonne National Lab., IL (USA)). Jun 1987. Contract W-31109-ENG-38. 21p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88003114/JAW.

From 16. symposium on nondestructive evaluation; San Antonio, TX, USA (21 Apr 1987).

An X-ray computed tomography (CT) imaging system and an analog tomographic system were used to examine a green-state Si_3N_4 test specimen. The CT system used was a state-of-the-art medical CT scanner with a polychromatic source. The film-based tomography system was a Siemens Optiplanimat with tungsten target and 2.5-mm Al filtration. It was operated in one scan pattern. Single-emulsion industrial film was used to increase spatial resolution. Results show that with the equipment and test specimens used, computed tomography is superior in size of defect detectable. 11 refs., 15 figs.

9322 **(CONF-8708190—1) Image correlation on an IBM-PC for characterization of advanced ceramics.** Vaitekunas, J.J.; Roberts, R.A.; Ellingson, W.A. (Argonne National Lab., IL (USA)). Oct 1987. Contract W-31109-ENG-38. 24p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88002829/JAW.

From Conference on nondestructive evaluation for aerospace requirements; Huntsville, AL, USA (26 Aug 1987).

Digital images generated by data from ultrasonic scans, radiography, x and gamma-ray CT (Computerized Tomography), and NMR (Nuclear Magnetic Resonance or MRI, Magnetic Resonance

Imaging) often allow rapid visual interpretation of the data. Methods to compare the data generated and shown in the different images would be very useful. At Argonne an inexpensive, high resolution system has been developed to provide a means of correlating information in the images generated by the different NDE methods. This paper describes the imaging system developed at Argonne and some of the techniques used to aid in correlating features in the images generated by the NDE methods. 4 refs., 11 figs.

9323 **(EUR—10831) Neutron radiography at the HFR Petten compilation of HFR Petten contributions to the second world conference on neutron radiography.** Markgraf, J.W.F. (ed.) -. (Commission of the European Communities, Petten (Netherlands). Joint Nuclear Research Center; Commission of the European Communities, Luxembourg). 1986. 63p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE88751595/JAW.

This booklet summarizes the six papers on neutron radiography activities at the Petten High Flux Reactor (HFR), presented at the Second World Conference on neutron radiography, held in June 1986 in Paris, France. The conference was organized by the French CEA and COFREND, and JRC Petten, HFR Division, with joint sponsorship of the national societies on Non-Destructive Testing (NDT) from the Federal Republic of Germany, United Kingdom, Japan and the United States. The Petten papers are concerned with: (i) the work of the Neutron Radiography Working Group (NRWG), an expert group operating under the auspices of the Commission of the European Communities represented by JRC Petten, HFR Division; (ii) applications of neutron radiography in research programmes performed at HFR; (iii) neutron radiography facilities at HFR; and (iv) image evaluation techniques.

9324 **(FhG-IzfP—860113-TW) Non-destructive testing of large containers at Stuttgart - ALOK part. Phase 1. ALOK with conventional test heads.** Kappes, W.; Barbian, O.A.; Paul, H.; Licht, R. (Fraunhofer-Gesellschaft zur Foerderung der Angewandten Forschung e.V., Saarbruecken (Germany, F.R.). Inst. fuer Zerstoerungsfreie Pruefverfahren). 1986. 76p. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88751490/JAW.

In the ALOK part of the large container programme (reactor safety programme), automated ultrasonic testing was done with conventional test head systems in the first phase. The test included selected fault positions inside the M4 circular weld and all fault levels of the 4/1 circular weld. The C pictures were produced online by two test techniques during each test run. The subsequent evaluation of the ultrasonic data included the production of C picture representations of other test functions, the selection of faulty areas and the cleaning up of original data in these areas by forming running time/place curves.

9325 (IAEA-TECDOC—421, pp 25-35) **Compatibility of candidate overpack materials with deep argillaceous HLW disposal environments.** Tas, H.A.W.; Debruyn, W.; Dresselaers, J. (Centre d'Etude de l'Energie Nucleaire, Mol, Belgium). May 1987. NTIS (US Sales Only), PC A10/MF A01. Order Number DE88700614/JAW. (CONF-860987—).

From Technical committee on materials reliability in the back end of the nuclear fuel cycle; Vienna, Austria (2 Sep 1986).

The Belgian R and D programme on the disposal of high level radioactive waste has been focused on the qualification of deep argillaceous formations for HLW disposal, because they have a number of inherent attractive characteristics and also because they are sufficiently abundant to cover the Belgian needs. A large number of corrosion resistant materials as well as some corrosion allowance materials have been tested. The laboratory test program included accelerated tests as well as exposure tests in simulated repository conditions. Initial "field" experiments have been performed in a near surface clay quarry. However, in order to obtain realistic corrosion rate estimates corrosion experiments with simultaneous monitoring of the clay environment parameters have been started in a 230 meters deep underground laboratory constructed in the Boom clay formation at Mol. Two types of experimental devices have been designed. In the first type coupons are mounted on an internally heated tubular holder and are directly exposed to the solid clay. In a second type of test a purge gas is used to extract corrosive products from the clay and circulate them subsequently over a number of metal coupons. Relevant parameters such as pH and Eh are continuously monitored for evaluating the evolution of soil agressivity after the initial chemical and mechanical disturbance of the clay, caused by the operations required for the introduction of the experimental devices. 3 figs.

9326 **(INIS-GB—101) 4. report of the Advisory Committee of the Inspection Validation Centre.** (UKAEA Risley Nuclear Power Development Labs. Inspection Validation Centre). Jul 1987. 4p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88751651/JAW.

The paper is the Fourth Report of the Management Advisory Committee (MAC) of the Inspection Validation Centre (IVC), 1987. The Committee was set up to review the policy, scope, procedure and operation of the Risley IVC. A description is given of the technical progress of the IVC during the year 1986/87. The MAC has also considered several aspects of the design basis for the proposed Sizewell 'B' reactor as reflected by the specifications placed upon the IVC. (U.K.).

9327 **(INIS-mf—10782) Experimental study on the application of acoustic emission analysis during RPV pressure tests. Pt. 2. Post-evaluation of the integral acoustic emission test. Final report.** Schulze, G. (Kraftwerk Union A.G., Erlangen (Germany, F.R.); Bundesministerium des Innern, Bonn (Germany, F.R.)). 1986. 32p. (In German). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88751513/JAW.

The digital data as recorded by the Battelle-Institute during the integral acoustic emission test (data storage by disc), were re-evaluated using particular post test analysis programs. The report outlines the essential characteristics of the acoustic source location method (KWU-SL) applied thereby. The evaluation results can be summarized as follows: Test measurements performed both on the inner and outer surface show that the KWU-SL method provides a reliable means for pinpointing of acoustic emission sources. A uniform high level of location quality is obtained for the RPV cylindrical shell as well as for the bottom part; the accuracy lies in the range of approximative twice the wall thickness and a few acoustic emission signals, originally located by the FLAIR computer program, were found by the KWU-SL method to be erroneous and have been eliminated. Most of the indications, however, proved to be correct and have only slightly be relocated. With 1 ref., 5 tabs., 10 figs..

9328 **(SAND—87-2695C) Relaxation of metastable semiconductor strained-layer structures by plastic flow.** Dodson, B.W.; Tsao, J.Y. (Sandia National Labs., Albuquerque, NM (USA)). 1987. Contract AC04-76DP00789. 15p. (CONF-871124—7). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88002729/JAW.

From Fall meeting of the Materials Research Society; Boston, MA, USA (30 Nov 1987).

The relaxation of misfit strain in metastable structures by plastic flow is described using a continuum model based on Haasen's picture of plastic flow in bulk diamond-phase semiconductors and the concept of excess strain. This model provides a unified explanation of the equilibrium critical thickness, the relaxation behavior of metastable strained-layer structures, and the "metastable" critical thicknesses reported in many semiconductor strained-layer geometries. 11 refs., 3 figs.

9329 **Compression materials testing at low to medium strain rates.** Kawahara, W.A. New York, NY; American Society of Mechanical Engineers (1987). 5p. (CONF-861211—). American Society of Mechanical Engineers, 345 East 47 St., New York, NY 10017.

From American Society of Mechanical Engineers winter meeting; Anaheim, CA, USA (7 Dec 1986).

Technical Paper 86-WA/MATS-15.

This paper addresses uniaxial compression testing techniques for purposes of material characterization at strain rates from 10/sup -6//s to 10/sup +2//s. The uniaxial compression test is also called the upset test or the Rastegaev test, wherein a right cylindrical specimen is homogeneously compressed along its axis between two

parallel platens. Following a terse review of compression testing techniques, the authors describe their efforts. Statically, at strain rates from 10/sup -5//s to 10/sup -1//s, they employ a computer-controlled servohydraulic test system designed especially for high stiffness and precision alignment. Software enhancements include the ability to perform strain rate changes to investigate a material's strain rate sensitivity, and subroutines to evaluate system compliance effects. Dynamically, to strain rates of 10/sup -2//s, they compress specimens with a hydraulic actuator in an open-loop mode using special fixturing.

9330 **Development of passive acoustic imaging for large heat transfer components.** Claytor, T.N.; Greene, D.A. (Argonne National Lab., IL, USA; General Electric Co., San Jose, CA, USA). pp 339-345 of Ultrasonics international 85, London, UK, 2-4 July 1985. Conference proceedings. Guildford, United Kingdom; Butterworth Scientific Ltd. (1985). (CONF-850794—).

From Ultrasonics international conference; London, UK (2 Jul 1985).

Price Pound 50.00.

A passive acoustic imaging system for acoustic source location with no restriction on source character is being developed for thermal-hydraulic components. The system is particularly useful in locating continuous or quasi-continuous acoustic emission sources such as leaks in steam generators or rapid rattling of tubes in steam generators. In the imaging system to be described, acoustic signals that emanate outward from the source, through the medium, are detected by an array of low-frequency accelerometers. These time domain functions are combined with a mesh mapping algorithm to produce a spatial image showing the location and intensity of the noise source.

4208 Electronic Circuits And Devices

REFER ALSO TO CITATION(S) 9021, 9139, 9179

9331 **(CONF-871006—16) Interfacing slave designs to Fastbus: Practical experience.** Downing, R.W.; Hoeflich, J.J.; Simaitis, V.J. (Illinois Univ., Urbana (USA); European Organization for Nuclear Research, Geneva (Switzerland)). 1987. Contract AC02-76ER01195. 4p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88002807/JAW.

From Nuclear science symposium; San Francisco, CA, USA (21 Oct 1987).

Standard interface designs help (1) eliminate design errors, (2) reduce design efforts, and (3) lead to a uniform bus-protocol interpretation. We have designed a number of Fastbus slave modules, using a standard interface circuit and standard design-verification tools based on Computer-Aided-Engineering (CAE) techniques. In this paper, we describe the standard interface, and the design and verification methodology. 3 refs., 2 figs.

9332 **(ORNL/TM—10512) Shielding effectiveness against electromagnetic interference.** Googe, J.M.; Hess, R.A. (Oak Ridge National Lab., TN (USA)). Oct 1987. Contract AC05-84OR21400. 16p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88003664/JAW.

The use of metal-filled and metal-coated plastics and other modified dielectric materials to replace metals for enclosures has created a need to test these materials for their electromagnetic interference (EMI) shielding effectiveness (SE). Shielding effectiveness involves a variety of electromagnetic environments, and useful data can be obtained from tests that carefully limit the environment to that of a plane wave. Such an environment can be created in a circular or rectangular transmission line. Two such transmission line test fixtures, which hold samples of the material to be tested, have been developed. The fixtures described in this report are the National Bureau of Standards (NBS) coaxial transverse electromagnetic (TEM) cell, and a dual TEM cell constructed at ORNL from a design suggested by the NBS. The NBS coaxial fixture is an improved version of the device recommended by the American Society for Testing and Materials (ASTM). The problems associated with measuring SE are well described in the literature. The two methods described here are the result of years of work to establish procedures and instrumentation that will produce acceptable data.

9333 **(SAND—87-0998) Testing an A/D converter.** Solomon, O.M. Jr.; Gowins, C.M.; Smith, D.A. (Sandia National Labs., Albuquerque, NM (USA)). Nov 1987. Contract AC04-76DP00789. 50p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88003723/JAW.

This report describes the testing of a 12-bit analog-to-digital conversion system that uses dithering and a digital averager to improve the accuracy of the system by 2 bits. Sinewaves are used as test signals. Errors caused by slight nonlinearities in the A/D converter transfer function are estimated by solving a nonlinear optimization problem. 11 refs., 20 figs., 2 tabs.

9334 **Iteratively designed optical correlation filters for distortion invariant recognition.** Sweeney, D.W.; Schils, G.F. (Combustion Research Facility, Sandia National Labs., Livermore, CA 94550). pp 102-110 of Hybrid image processing. Casasent, D.P.; Tescher, A. Bellingham, WA; SPIE Society of Photo-Optical Instrumentation Engineers (1986). (CONF-860366—).

From SPIE technical symposium on applications of artificial intelligence; Orlando, FL, USA (31 Mar 1986).

An iterative method is used to design distortion invariant correlation filters. Target images can be detected, for example, independently of their position, rotation, or scale. Optical correlation filters designed using this technique retain full position invariance. The filter design begins by finding the distortion invariant modes for a particular image. This paper reviews the basic design process for a filter that is position, rotation, and intensity invariant. The emphasis is on determining the practical utility of the proposed methods and demonstrating the filters experimentally. Numerical simulations demonstrate that the proposed method can detect targets that are buried in noise. Computer generated holographic filters are fabricated using an electron beam. Experimental results are in excellent agreement with analytical and numerical computations.

9335 **A high-bandwidth fiber-optic system using laser-diode transmitters.** Pruett, B.L.; Roeske, F.; Jones, R.A.; Hagans, K.G.; Davies, T.J.; Nelson, M.A.; Gong, G.C. (Lawrence Livermore National Lab., P.O. Box 808, Mail Stop L-45, Livermore, CA 94550). pp 193-196 of Fiber optic and laser sensors III. Moore, E.L.; Ramer, O.G. Bellingham, WA; SPIE Society of Photo-Optical Instrumentation Engineers (1985). (CONF-850887—). Contract W-7405-ENG-48.

From SPIE international technical symposium on optical and electro-optical engineers; San Diego, CA, USA (18 Aug 1985).

A system has been developed to transmit analog signals through 1-km-long fiber-optic cables having bandwidths up to 1.5 HGz. Semiconductor injection laser-diode transmitters operating at a wavelength of about 815 nm are directly modulated by electrical signals from radiation detectors. Graded-index optical fibers transmit the optical signals to a remote facility, where they are recorded on a single streak camera.

9336 **Spectrally-broad picosecond light source.** Rotter, M.D. (Lawrence Livermore National Lab., Univ. of California, P.O. Box 5504, Mail Stop L-54, Livermore, CA 94550). pp 372-374 of Fiber optic and laser sensors III. Moore, E.L.; Ramer, O.G. Bellingham, WA; SPIE Society of Photo-Optical Instrumentation Engineers (1985). (CONF-850887—). Contract W-7405-ENG-48.

From SPIE international technical symposium on optical and electro-optical engineers; San Diego, CA, USA (18 Aug 1985).

The authors describe a fast (35 ps or less), spectrally broad (at least 600 nm) light source for use in characterizing and calibrating photonics equipment. The spectral output of the source is described, and examples of its use are given.

4209 Waste Processing Plants And Equipment

REFER ALSO TO CITATION(S) 8585

4210 Combustion Systems

REFER ALSO TO CITATION(S) 8381, 8433, 8441, 9006

9337 (N—87-28869) High temperature static strain gage development contract, tasks 1 and 2. Interim report. Hulse, C.O.; Bailey, R.S.; Grant, H.P.; Przybyszewski, J.S. (United Technologies Research Center, East Hartford, CT (USA)). Jul 1987. 82p. (NASA-CR—180811; NAS—1.26:180811; R—87-916527-1). NTIS, PC A05/MF A01.

Results are presented for the first two tasks to develop resistive strain gage systems for use up to 1250 K on blades and vanes in gas turbine engines under tests. The objective of these two tasks was to further improve and evaluate two static strain gage alloys identified as candidates in a previous program. Improved compositions were not found for either alloy. Further efforts on the Fe-11.9Al-10.6Cr weigth percent alloy were discontinued because of time dependent drift problems at 1250 K in air. When produced as a 6.5 micrometer thick sputtered film, the Pd-13Cr weight percent alloys is not sufficiently stable for this use in air at 1250 K and a protective overcoat system will need to be developed.

9338 Influence of solids hydrodynamics on local heat transfer from tube banks immersed in a gas fluidized bed. Moslemian, D.; Chen, M.M.; Chao, B.T. New York, NY; American Society of Mechanical Engineers (1987). 8p. (CONF-861211—). American Society of Mechanical Engineers, 345 East 47 St., New York, NY 10017.

From American Society of Mechanical Engineers winter meeting; Anaheim, CA, USA (7 Dec 1986).

Technical Paper 86-WA/HT-77.

Many empirical correlations for predicting heat transfer between a gas fluidized bed and the immersed internals have been proposed. They are based mainly on gross experimental observations with minimal attention to the mechanism of heat transfer due, at least in part, to the lack of systematic data on solids motion. Much useful insight can be obtained from a simultaneous determination of the local heat transfer rates from immersed internal structures and the associated hydrodynamics of the solid particles. In this study, the local mean heat transfer coefficients of horizontal internals simulating tube banks were measured for several locations in the bed along with measurements of the mean solids velocity and density distributions for a range of superficial gas velocities. The experiments were conducted in a 184 mm (7.25 in.) ID air fluidized bed with a horizontal in-line internal rod bundle of 16 mm (0.625 in.) OD with pitch-to-diameter ratio of 4 over a wide range of gas velocities. The results showed that the local heat transfer rates depend strongly on the flow pattern of solids induced by the bubble motion. The data confirmed the expectation that particle convection plays a major role in the mechanisms of heat transfer from immersed internals.

9339 Eddy current inspection of steam generator tubing. Deeds, W.E.; Dodd, C.V. (Metals and Ceramics Div., Oak Ridge National Lab., Oak Ridge, TN 37830). pp 175-194 of Electromagnetic methods of nondestructive testing. Lord, W. New York, NY; Gordon and Breach Science Publishers Inc. (1985).

The importance and difficulties of eddy current inspection of steam generator tubes are now becoming recognized. It is also apparent that the testing must be quite sophisticated to distinguish the serious flaws from harmless variations in the tubing or surroundings. Multiple-frequency or pulsed eddy currents and perhaps multiple-coil arrays are necessary to gather enough data to establish the necessary facts. Relatively small coils pressed flat against the inner wall of the tube are more sensitive than large circumferential coils to small outside diameter flaws, and arrays of such coils may be required for some applications. A digital computer is essential to process the data with the required accuracy.

4250 Power Cycles

9340 (EUR—10951-FR) ESTHER pipe. First operational results. Final report. Durin, M.; Goldstein, S.; Lamoureux, M.; Le Sech, A.; Souletie, P. (Commission of the European Communities, Luxembourg. Directorate General Telecommunications, Information Industries and Innovation). 1987. 39p. (In French). Commission of the European Communities, Luxembourg. Office of Official Publications of the European Communities.

Energie.

CEA investigated the technical feasibility of a topping cycle with sulphur as a working fluid (600-750/sup 0/C) in combination with a conventional steam cycle for the production of electricity. The overall energy conversion efficiency is estimated to be 60%. This investigation will use an experimental installation to study the properties of sulphur as a working fluid in a high-temperature thermodynamic cycle. The programme included the design, construction and operation of this installation. Above 400/sup 0/C the experimental data available are unreliable. CEA established the required data for the properties of sulphur at high temperatures (up to 800/sup 0/C). There are technical difficulties in the construction of the main loop and preliminary tests were necessary. The problem of corrosion of steel by sulphur at high temperatures had been solved previously (an internal protective coating of alumina was used). CEA also tested the corrosion of small components under real plant conditions in a special loop. To better estimate pressure drops and heat transfer coefficients, experiments have been carried out in a test rig. The main loop was designed in detail and constructed and preliminary tests have been carried out.

43 PARTICLE ACCELERATORS

9341 (RAL—86-039) Options for machines and experiments in the future. Kalmus, P.I.P. (Rutherford Appleton Lab., Chilton (UK)). May 1986. 14p. (CONF-8506379—). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88750782/JAW.

From Meeting on quarks and leptons: the new elementary particles; London, UK (14 Jun 1985).

Published in Proc. R. Soc. (London), Ser. A, Vol. 404, 1986 pp. 285-298.

The highest energy particle accelerators in operation and under construction are described briefly, together with a selection of detectors. Extrapolations of existing techniques both for accelerators and for detectors appear to be adequate for the next upward step in energy, but beyond this new techniques will probably have to be developed. Some predictions are given.

4301 Design, Development, And Operation

9342 (AERE-R—11946) Improvements to the Harwell Van de Graaff accelerator. Read, P.M.; Stevens, J.H. (UKAEA Atomic Energy Research Establishment, Harwell. Nuclear Physics Div.). Jan 1986. 25p. H.M. Stationery Office, London, price Pound 4.00.

The Harwell Van de Graaff has been rebuilt with a new high voltage column, accelerator tube and laddertron charging system. The facility now provides analysed proton beams of up to 60 μA and terminal voltages of up to 4.6MV. Beam current, energy and position on target are stable for long periods of continuous operation. Measurements of beam brightness and energy spread are encouraging for microbeam applications.

9343 (AERE-R—12012) Fundamental physics research at Harwell in the 1950s. II. The Van de Graaff Group (Nuclear Physics Division). Freeman, J.M. (UKAEA Atomic Energy Research Establishment, Harwell. Nuclear Physics Div.). Mar 1986. 29p. H.M. Stationery Office, London, price Pound 5.00.

The report describes the fundamental physics research carried out by the Van de Graaf Group of the Nuclear Physics Division, Harwell, in the 1950's. The research programmes included: nuclear structure of very heavy elements, energy levels of light

nuclei and nuclei and nuclear models, radiative deuteron capture in a medium weight nucleus, and fast neutron physics. A brief account is also given of the origins and development of the Van de Graaf accelerator and group. (U.K.).

9344 **(IAE—4338/14) Cyclotron modification for /sup 201/Tl production.** Venikov, N.I.; Kalinin, S.V.; Kolesnikov, O.N. and others. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii). 1986. 16p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88700852/JAW.

A meter-and-a-half isochronous cyclotron is reconstructed for the purpose of producing radioactive isotopes in it with a possibility of a fast transition to acceleration of semiheavy ions, used for nuclear-physical investigations. Ion source brightness increase, substantial reduction of the accelerated beam emittance by radial-phase collimation reduction of beam losses during extraction and transport, RF system reconstruction, start-up of remote control target device have provided for a reliable target irradiation by 600 W power beam without target thermal destruction. 10 refs.; 9 figs.

9345 **(JINR—9-86-647) Dubna synchrophasotron. Operation and improvement (quarter 1, 1986).** Voevodin, M.A.; Glushchenko, V.G.; Doroshenko, A.Z. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy). 1986. 6p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88700464/JAW.

Information is presented on the JINR synchrotron operation in the first quarter, 1986. A system of accelerated beam extraction in two directions and a system of beam transport in the experimental halls are described. Much attention has been given to pulsation in the magnetic field. The improvement of the structure of the extraction beam makes it possible to increase an effective duration of slow extraction by a factor of several times. Geodetic measurements are being continued. 4 refs.; 3 figs.; 3 tabs.

9346 **(JINR—9-87-7) Dubna synchrophasotron. Operation and improvement (quarter 3, 1986).** Buldakovskij, V.N.; Valevich, A.I.; Voevodin, M.A. and others. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy). 1987. 5p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88700897/JAW.

Information on the accelerator operation in quarter 3, 1986 is presented. The elements of the magnetic optics in a transport system of extracted beams are aligned in two directions (MB-1 and MB-2). The equipment of the transport channel in building 205 with wire ionization chambers for measuring beam parameters is being continued. To improve qualitative characteristics of the beam ejected in the MB-2 direction, some work has been done on the formation and measurement of the parameters of the end magnetic field using a model of the main magnet of the accelerator. A protective screen of the ionization chamber placed inside the vacuum chamber of the accelerator is described. Data on the behaviour of a "group" of bench marks are given. Improvements in the systems of the polarized deuteron source "Polaris" are descibed. 2 refs.; 3 figs.; 2 tabs.

9347 **(RAL—86-030) Saturation of plasma heat waves by collisional damping.** Bingham, R.; Evans, R.G.; Cairns, R.A.; Dangor, A.E.; McKinstrie, C.J. (Rutherford Appleton Lab., Chilton (UK)). Apr 1986. 10p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88750711/JAW.

The authors analyze the saturation mechanism for the electrostatic plasma wave excited by two electromagnetic waves in a hydrogen plasma, and show that collisional damping can significantly change the saturation level determined by the relativistic frequency shift. The results will be compared with measurements obtained from recent laboratory experiments.

9348 **Application of picosecond CO/sub 2/ lasers to particle accelerators.** Bigio, I.J.; Kurnit, N.A.; Shimada, T.; Harrison, R.F. (Los Alamos National Lab., Los Alamos, NM 87545). pp 10 of Proceedings of the conference on lasers and electro-optics. Piscataway, NJ; IEEE Service Center (1987). (CONF-870401—).

From OSA/IEEE conference on lasers and electro-optics (CLEO '87); Baltimore, MD, USA (27 Apr 1987).

Technical Paper MC1.

It is interesting to note, that in projecting from the laser requirements of a demonstration experiment to those of a scaled system, probably fewer leaps of faith are required in the case of one such scheme - laser-driven open structures - than for many other currently proposed concepts. In this work the authors list the laser specifications required by the initial demonstration experiments and also envisioned for a replicated subunit of a scaled accelerator system. The intent is to bolster the argument that there is already a technology base from which to extrapolate future development. In the case of the requirements for the initial experiments, all the specifications can either be met or exceeded by the system currently under construction. The system under construction for a proof-of-principle demonstration is described, and the various advantages and disadvantages that lasers bring to such schemes are discussed.

4302 Beam Dynamics, Field Calculations, And Ion Optics

9349 **(DOE/ER/40136—T6) Electron acceleration by laser fields in a gas: Technical progress report.** Fontana, J.R. (California Univ., Santa Barbara (USA). Dept. of Electrical and Computer Engineering). 1 Dec 1987. Contract AS03-84ER40136. 9p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88003337/JAW.

Alternative media are considered for inverse Cherenkov interactions, with refractive indices given for several neutral gases. Breakdown considerations are taken into account as well as elastic collisions. Properties of ionized gases are also discussed as they relate to the usefulness of plasmas as accelerator media. The planning for inverse Cherenkov interaction experiments at a CO_2 laser, 50 MeV electron linac test facility is being carried out. (LEW)

9350 **(IFVE-OUNK—86-74) Increase of longitudinal phase volume of an intense bunch in synchrotron critical energy region.** Balbekov, V.I.; Malovitskij, A.Yu. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1986. 12p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88700405/JAW.

Interaction of an intense bunch with a low-Q-factor cavity resonator in the critical energy region at the IHEP accelerator is considered. The calculated data have shown that there is a sharp increase of longitudinal phase volume of the bunch when critical energy passage as well as the appearance of the bunch current high-frequency component. The latter grows slowly in the subcritical region and gives a sharp splash "just after critical" energy passage. The calculated results are in good qualitative agreement with the experimental data obtained before. 7 refs.; 4 figs.; 3 tabs.

9351 **(ITEF—31-1986) Experimental study on the phase volume growth of an intense electron beam.** Martynov, S.V.; Pershin, V.I.; Plotnikov, V.K.; Popova, N.Ya. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1986. 19p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88700442/JAW.

The effect of the phase volume growth of an accelerated intense electron beam in a vacuum is experimentally investigated. The in-beam experiments were carried out with the LIU-5/5000 accelerator electron gun. The value of the phase volume increase is shown to be determined by proper beam space charge. Restrictions of the regime of correct beam transport in a vacuum at large distances associated with the mentioned effect are discussed. 6 refs.; 5 figs.

9352 **(ITEF—34-1986) Thermodynamics of a charged particle beam. Beam entropy growth during its acceleration and transport.** Batalin, V.A. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1986. 24p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88700443/JAW.

Consideration of the beam emittance growth based on the analysis of solution of the system of equations of motion for charged particle ensemble is carried out. The system of equations of motion is obtained by meas of the Lagrange function with a generalized potential including Helmholtz bound energy. The consideration points out existence of at least three types of processes resulting in the beam emittance growth at its transport and acceleration: effects similar to optics aberrations associated fields and non-linearity of forces of proper space charge; changes in beam temperature and entropy without heat exchange with external energy sources (they are similar to reversible thermodynamic cycles); processes with heatinflow and outflow, particularly, irreversible phenomena in particle beams resulting in entropy generation. 10 refs.; 3 figs.

9353 **(ITEF—64-1986) Admissible errors for parameters of a focusing channel of a linear induction accelerator with intense electron beam. 3. Estimation of tolerances on the example of the LIU-5/5000 accelerator.** Plotnikov, V.K. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1986. 11p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88700445/JAW.

Estimation of tolerances for parameters of a focusing channel of the LIU-5/5000 induction linac is carried out. An intense beam with non-zero phase volume of transverse motion can have a stationary distribution function for particle density in the focusing channel with a longitudinal magnetic field only at the absence of a magnetic field on the cathode. The amplitude of dipole coherent oscillations essentially depends on initial displacement (due to non-axial beam transport of a section with a radial electric field in the accelerating gap of an electron gun) and initial beam angle (due to low frequency of dipole coherent oscillations). The slope of magnetic axes of focusing elements makes the largest contribution to the growth of an amplitude of coherent beam oscillations. 3 refs.; 2 tabs.

9354 **(ITEF—173(1985)) Selfstabilization of ribbon beam coherent oscillations.** Zenkevich, P.R.; Korolev, A.P. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1985. 10p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88700889/JAW.

The Coulomb field nonlinearity of a nonrelativistic beam leads to betatron oscillation frequency spread stabilizing free coherent oscillations related to a collective electrostatic field. The self-stabilizing effect is studied for ribbon beams using the method of linearization of the system of Vlasov equations, which numerical solution in the single-mode approximation has permitted to study the dependence of coherent oscillation eigenfrequencies on the mode number n and parameter s characterizing the form of the particle distribution function in phase space. It is shown that Coulomb dispersion for s actual values leads to self-stabilization of all modes with $n \geqq 3$. 7 refs.; 1 fig.

9355 **(LAL-RT—87-09) Interference effects between depolarization resonances and higher-order corrections to perturbed spin motion in synchrotrons and storage rings.** Buon, J. (Paris-11 Univ., 91 - Orsay (France). Lab. de l'Accelerateur Lineaire). Jan 1987. 19p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88751634/JAW.

It is shown that interference effects between depolarization resonances lead to a resonance shift and to appearance of higher-order satellite resonances. Resonance shift can bias energy calibration by depolarization technique. Higher-order corrections to spin diffusion in electron storage rings are studied in the vicinity of one or two resonances and are found important only when depolarization is large. Validity of spin-matching conditions for spin rotators is also studied at higher order.

9356 **(SLAC-PUB—3641) The "phase velocity" of nonlinear plasma waves in the laser beat-wave accelerator.** Spence, W.L. (Stanford Linear Accelerator Center, Menlo Park, CA (USA)). Apr 1985. Contract AC03-76SF00515. 3p. (CONF-850504—318). NTIS, PC A02. Order Number DE88003612/JAW.

From Particle accelerator conference; Vancouver, Canada (13 May 1985).

A calculational scheme for beat-wave accelerators is introduced that includes all orders in velocity and in plasma density, and additionally accounts for the influence of plasma nonlinearities on the wave's phase velocity. The main assumption is that the laser frequencies are very large compared to the plasma frequency - under which it is possible to sum up all orders of forward Raman scattering. It is found that the nonlinear plasma wave does not have simply a single phase velocity, but that the beat-wave which drives it is usefully described by a non-local "effective phase velocity" function. A time-space domain approach is followed. (LEW)

9357 **(SLAC-PUB—4433) A qualitative study of wake fields for very short bunches.** Palmer, R.B. (Stanford Linear Accelerator Center, Menlo Park, CA (USA)). Oct 1987. Contract AC02-76CH00016;AC03-76SF00515. 8p. (CONF-8708177—1). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88002565/JAW.

From Workshop on impedance beyond cutoff; Berkeley, CA, USA (18 Aug 1987).

A qualitative treatment is given of both single and multiple cavity wakefields, with the intent of providing some physical insight into the energy and bunch length dependencies. (LEW)

9358 **(SLAC-PUB—4490) Coherent beamsstrahlung.** Spence, W.L. (Stanford Linear Accelerator Center, Menlo Park, CA (USA)). Nov 1987. Contract AC03-76SF00515. 3p. (CONF-850504—317). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88000720/JAW.

From Particle accelerator conference; Vancouver, Canada (13 May 1985).

The radiation coherently emitted by a high energy bunched beam suffering an arbitrarily large disruption in a collision with an idealized undisrupted beam is calculated. The near-luminal velocity of the beam - such that the emitted radiation moves very slowly with respect to the bunch - implies that only a small part of the bunch radiates coherently and necessitates a careful treatment of the disrupted beam phase space during emission. The angular distribution and spectral density are presented. It is found that most of the radiation is at wave lengths greater than or equal to the bunch length and that the total energy lost by the beam due to coherent effects should be negligible in high energy-high luminosity linear colliders. 4 refs.

4303 Auxiliaries And Components

9359 **(ITEF—13-1986) Fast two-coordinate profilometer based on a proportional chamber with data output at an oscillograph screen.** Goryainov, N.A.; Efremenko, Yu.V.; Kuznetsov, S.G.; Smirnitskij, A.V.; Shvartsman, B.B. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1986. 10p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88700440/JAW.

The design and basic characteristics of a fast two-coordinate profilometer based on a proportional chamber with data output on an oscillograph screen are described. The profilometer is standardly used in real-time experiments at the ITEP accelerator for off-line control of the position and shape of a relativistic charged particle beam with intensity of ~ 10/sup 3/ to ~ (5-6) x 10/sup 6/ particle/s and sizes of 1-10 cm/sup 2/. Because of a microprocessor installed inside the data acquisition, exchange and output system, the profilometer provides a wide variety of service potentialities. 3 refs.; 3 figs.

9360 **(ITEF—93-1986) Heavy ion detection by microchannel plates.** Barabash, L.Z.; Krechet, K.I.; Bykovskij, Yu.A.; Kondrashev, S.A.; Khajdarov, R.T.; Sharkov, B.Yu. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1986. 11p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88700449/JAW.

The contribution of different mechanisms of secondary electron emission to the value of the conversion coefficient is estimated. Secondary emission properties of materials of microchannel plates channels are studied; dependences on ion energies in the 0-12 keV and Z 1-5 ranges are measured. Energy thresholds with different Z is determined. A possibility of using microchannel plates for ion and neutral atom detection is discussed on the base of the data obtained. 8 refs.; 5 figs.

9361 **(JINR—9-86-714) Nonlinearity of nuclotron superconducting dipole magnetic field.** Borisovskaya, Z.V.; Donyagin, A.M.; Smirnov, A.A.; Shelaev, I.A. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy). 1986. 9p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88700465/JAW.

The nonlinearity of magnetic field for superconducting dipole of nuclotron has been investigated for all current operating range. It is shown that the nonlinearity is 0.1% in the dipole central region at RN=1.9 cm distance of normalized radius. The integrated nonlinearity for model superconducting dipole is about 0.2%. It is shown that for 1.5 thick insulation gap between the winding ending and the iron yoke the integrated nonlinearity is less than 0.1%. The MAGSYS program package is used for calculation of three-dimensional magnetostatic fields, for calculation of central field-the POISSON (POISCR) program package. The calculation results are given in comparison with the results on measuring the dipole superconducting field at liquid helium temperature. A good correspondence between these results for the fields is less than 1.6T (5 x 10/sup -4/). For the field more than 1.6 T the saturation of iron yoke of the magnet occurs, and a correspondence between the measurement and calculation results is only 1 x 10/sup -3/. 5 refs.; 8 figs.; 4 tabs.

9362 **(JINR—9-86-753) Design of the nuclotron beam transport channels.** Bruners, G.A.; Vasilishin, B.V.; Issinskij, I.B.; Kostyuchenko, S.V.; Mikhajlov, V.A.; Senner, A.E.; Shutova, N.A. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy). 1986. 8p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88700466/JAW.

A general view and main parameters of the nuclotron beam transport lines are presented. The chosen scheme makes it possible to realize the injection of heavy ions with 5 MeV/nucleon energy and slow exctraction over a wide range in the existing directions of the synchcrophasotron. Since the ring of the nuclotron is placed at -3.9 m level relatively to the equipment available, the beam transport lines must be with horisontal and vertical bends of the beam. The interactive computer program and calcultions of the channels performed by means of it are presented. The injection line is intended for beam transport from the linac to nuclotron and includes 10 quadrupole lenses with G $\leq$ 5 T m gradients and 2 dipole magnets. The maximum size of the beam in channel is 72 mm. The SE1 and SE2 lines transport the beam from the nuclotron to existing channels, in the experimental halls. They include 11 and 3 quadrupole lenses (G~34 T/m), respectively, 3 and 7 dipole magnets. The beam sizes in the channels are less than 62 mm. 6 refs.; 6 figs.; 6 tabs.

9363 **(JINR—9-86-785) Production of extracted beams on IC-100 cyclic implantator.** Gul'bekyan, G.G.; Klenin, B.A.; Morduev, A.M.; Oganesyan, R.Ts.; Hawliczek, K.; Chugreev, V.A. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Reactions). 1986. 6p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88700467/JAW.

The creation of heavy ion cyclic implantator has been completed at the Laboratory of Nuclear Reactions, JINR. The extraction of accelerated beams was realized by two methods: with the use of the electrostatic deflector and by stripping of carbon target. The extracted ion beams of elements from /sup 12/C to /sup 40/Ar with 1-1.2 MeV/nucleon energy have been received. The efficiency of the electrostatic extraction is about 50%. The constraction of electrostatic deflector is described. The main parameters of electrostatic and stripping extraction are presented. 7 refs.; 4 figs.; 1 tab.

9364 **(JINR—13-86-736) Optimization of outlet channel of plasma ion source.** Kiszczak, K.; Lyatushinski, A.; Monchka, D.; Yushkevich, Yu.V. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems). 1986. 6p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88700471/JAW.

Design and operation principle of arc hollow-cathode ion source are presented. The effect of source outlet length on emitted ion current and ionization efficiency have been investigated by means of this source. Empirical formula for calculating the source ionization efficiency has been derived, and some its characteristics are presented. The noticible effect of emission channel geometry on ion currents of the source and efficiency of using working substance is shown. 4 refs.; 7 figs.; 1 tab.

9365 **(JINR—13-86-749) Semiconductor spectrometer for low-energy pion plus beams.** Gajsak, I.I.; Gornov, M.G.; Gurov, Yu.B. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems). 1986. 4p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88700473/JAW.

Submitted to the journal Instrum. Exp. Tech. .

A device based on semiconductor spectrometer for measuring low-energy pion plus beam momentum distribution is described. The device is a cylindrical chamber enclosing semiconductor detectors on movable vacuum sealed rods and the gauge α-source. Pion spectrum is determined by measring the energy of accompanying heavy charged particles (p, d, t, α) by total absorption in a thin semiconductor detector. The accuracy of mean beam momentum determination is <or approx. 10/sup -3/. The given technique permits to control and if needed to correct beam parameters in the experiment. 3 refs.; 2 figs.

9366 **(JINR-R—9-87-24) On tolerancies for random spread of axes of focusing magnetic field coils in linear induction accelerators.** Kazarinov, N.Yu.; Kazacha, V.I. (Joint Inst. for Nuclear Research, Dubna (USSR). Dept. of New Acceleration Methods). 1987. 7p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88700925/JAW.

It si shwon that existing in a real magnetic system of a linear induction accelerator (LIA) random spread of the axes of the focusing magnetic field separate coils relatively to the accelerator axis reduces to the centre of the beam mass precession, leads to the increasing of generalized momentum and to appearance of particle coherent angle at the accelerator exit. The correlation functions connected with the random spread of the coils center coordinates relatively to the LIA axis are determined, and the quantity of the coherent angle and amplitude of the precession at the accelerator exit are evaluated. 5 refs.; 3 figs.

9367 (KEK—86-13, pp 51-53) **Anti-proton bottles at KEK.** Hirabayashi, H. (National Lab. for High Energy Physics, Oho, Ibaraki, Japan). Mar 1987. NTIS (US Sales Only), PC A09/MF A01. Order Number DE88780031/JAW. (CONF-8701101—).

From Symposium on hadron spectroscopy; Oho, Ibaraki, Japan (8 Jan 1987).

9368 **(LAL-RT—87-08) Ring model of the Lasertron.** Tallerico, P.J.; Coulon, J.P. (Los Alamos National Laboratory, N.M., USA). (Paris-11 Univ., 91 - Orsay (France). Lab. de l'Accelerateur Lineaire). Mar 1987. 22p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88751633/JAW.

The lasertron is a device to transform high voltage power to microwaves, and it is much like a klystron with a photocathode. The beam is bunched in the lasertron by the laser light that is modulated at the microwave frequency. The photoelectrons are produced at a cathode, and accelerated to a fairly high voltage in the gun region by an electric field. These electrons produce microwaves in the output section, which is one or more cavities that decelerate the beam with the microwave fields. The purpose of this paper is to develop a computer model of the lasertron. This model can be used to predict general trends in lasertron performance on

the device parameters, and the model can also be used to design lasertrons for particular applications. The ring model of the electrodynamics in the klystron has recently been written. The main features of the ring model of the lasertron are as follows. The relativistic electron dynamics of a set of particles are followed from the photocathode through the gun region and through the output region, with time as the independent variable. The fields are summed by superposition to find the total field at each electron's position. The model is 2 1/2 dimensional. A single bunch of electrons is followed through the lasertron. The program is modular and flexible, so many of the fields can be approximated in several ways to alter the accuracy and time requirements to perform the simulation. The particles all have the same charge, so the laser light pulse is assumed to be rectangular. All processes in the photo cathode are assumed instantaneous. The beam model is a central disk surrounded by rings. This combination starts at the cathode in a plane, and is repeated many times over the length of the laser pulse.

9369 **(UCID—20881) Dosimetry measurements of x-ray and neutron radiation levels near the shuttle and end beam dump at the advanced test accelerator: Beam Research Program.** Gibson, T.A. Jr.; Struve, K.W.; Lindgren, R.A. (Lawrence Livermore National Lab., CA (USA)). 1987. Contract W-7405-ENG-48. 28p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88000443/JAW.

Electron beams as a source of directed energy are under study at the Lawrence Livermore National Laboratory (LLNL). An intense 10-kA, 50-MeV, 50-ns full-width half-maximum, pulsed electron beam is generated by the prototype Advanced Test Accelerator (ATA) at the Laboratory's Site 300. Whenever the electron beam is stopped in materials, intense radiation is generated. Estimates based on available data in the literature show that for materials such as lead, photon radiation (x ray, gamma, bremsstrahlung) levels can be as large as 10^4 roentgens per pulse at 1 m in the zero-degree direction (i.e., the electron-beam direction). Neutrons, which are emitted isotropically, are produced at a level of 10^{13} n/m^2 per pulse. Depending upon the number of pulses and the shielding geometry, the accumulated dose is potentially lethal to personnel and potentially damaging to instrumentation that may be used for diagnostics. To provide shielding for minimizing the risk of exposure to personnel and radiation damage to instrumentation, it is important to determine the x-ray and neutron radiation environment near beamline components such as the beam shuttle dump and beam stop. Photon and neutron dosimetry measurements were performed around the beam shuttle dump on January 9, 1985, and near the carbon beam stop at the end of the beamline before the entrance to the diagnostic tunnel on April 12 and December 23, 1985. These measurements together with simple rule-of-thumb estimates and Monte Carlo electron-photon shower calculations of the absorbed dose are presented in this report. 17 refs., 14 figs., 13 tabs.

4304 Storage Rings

9370 **(IFVE-OUNK—86-161) Calorimetric method of heat release measurement in the UNK superconducting magnets.** Ageev, A.I.; Bozhko, Yu.G.; Zhirnov, A.V. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1986. 8p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88700406/JAW.

A calorimetric method for measuring stationary and non-stationary heat release in the UNK superconducting magnets during cryostating in a circulating mode is considered. Measurement errors are analyzed. The results obtained when measuring heat release in models of the UNK superconducting dipoles are presented. The developed calorimetric method permits to determine superconducting magnet heat release deposited on the cryogenic system with an error not more than 11%. Such accuracy is attained by using one thermotransducer for measurements. In contrast to the known electrical methods the given method can be applied for measuring heat release by different components of the magnetic cycle. 7 refs.; 6 figs.

9371 **(SLAC-PUB—4447) The electron damping ring for the SLAC Linear Collider.** Davies-White, W.; Hutton, A.; Harvey, A. (Stanford Linear Accelerator Center, Menlo Park, CA (USA); Los Alamos National Lab., NM (USA)). Oct 1987. Contract AC03-76SF00515. 5p. (CONF-870901—15). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88003608/JAW.

From 10. international conference on magnet technology (MT-10); Boston, MA, USA (21 Sep 1987).

A second damping ring to store and damp two electron bunches for the SLC project was constructed in 1985 and brought into operation early in 1986. Although generally similar to the damping ring (now used for positrons) constructed earlier, there are a number of design improvements and changes. The dipole magnetic field was raised to 2.1 T to improve damping. Sextupole fields were provided by separate permanent magnets, rather than being incorporated in the dipoles. The vacuum chambers, including the beam position monitors, were re-designed for lower longitudinal impedance. A new kicker was developed by Fermilab to handle the two electron bunches. Improvements were made to the dc septum magnet design. Several of the features are described in detail elsewhere. Where possible, the improvements were incorporated in an upgrade of the earlier damping ring.

44 INSTRUMENTATION

REFER ALSO TO CITATION(S) 9021

4401 Radiation Instrumentation

REFER ALSO TO CITATION(S) 8670, 9180, 9365, 9873, 9983, 10370

9372 **(AERE-M—3464) Solid state alpha particle floor monitor.** Brown, A.R. (UKAEA Atomic Energy Research Establishment, Harwell. Instrumentation and Applied Physics Div.). Mar 1986. 8p. H.M. Stationery Office, London, price Pound 4.00.

A new type of alpha sensitive floor monitor is described in which the detectors are large area silicon diffused junction diodes mounted in a highly manoeuvrable trolley assembly. The unit incorporates a battery operated ratemeter and the design is such that vertical surfaces may be conveniently monitored.

9373 **(ANL-HEP-CP—87-80) Simulating SSC event detection.** Blair, R.E. (Argonne National Lab., IL (USA)). 1987. Contract W-31109-ENG-38. 5p. (CONF-8705222—1). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88003125/JAW.

From Workshop on physics simulations at high energy; Madison, WI, USA (11 May 1987).

The author, a novice user of the CERN detector simulation package GEANT, offers a very brief summary of some of the strengths and weaknesses of the program, along with some indications of what must be done to implement a useful detector simulation for the SSC energy scale.

9374 **(DOE/ER/03956—T2) Report of the Working Group on the physics of hadronic showers.** Brau, J.E.; Stacey, B.; Abraham, D.; Derrick, M.; Fesefeldt, H.; Fukui, Y.; Gabriel, T.A.; Givernaud, A.; Kowalski, H.; Nodulman, L. (Tennessee Univ., Knoxville (USA)). [1987]. Contract AS05-76ER03956. 11p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88002752/JAW.

This paper discusses hadronic shower codes for studies of compensation in uranium calorimeters. In particular, the paper emphasizes the use of Monte Carlo calculations to correct for electromagnetic response in SLD calorimeters. 23 refs., 4 figs. (LSP)

9375 (DOE/ER/03956—T3) Report of the compact detector subgroup. Kirkby, J.; Kondo, T.; Olsen, S.L. (Rochester Univ., NY (USA); European Organization for Nuclear Research, Geneva (Switzerland); KEK, Tsukuba-gun, Ibaraki-ken (Japan)). [1988]. Contract AS05-76ER03956. 84p. NTIS, PC A05/MF A01; 1; GPO Dep. Order Number DE88002751/JAW.

This report discusses different detector designs that are being proposed for Superconducting Super Collider experiments. The detectors discussed are: Higgs particle detector, Solid State Box detector, SMART detector, muon detection system, and forward detector. Also discussed are triggering strategies for these detectors, high field solenoids, barium fluoride option for EM calorimetry, radiation damage considerations, and cost estimates. (LSP)

9376 (GKSS—87/E/13) Development and use of a position-sensitive multiwire proportional counter as area detector for neutron radiography. Wrobel, M. (GKSS-Forschungszentrum Geesthacht G.m.b.H., Geesthacht-Tesperhude, Germany, F.R.. Inst. fuer Physik). (GKSS-Forschungszentrum Geesthacht G.m.b.H., Geesthacht-Tesperhude (Germany, F.R.); Hamburg Univ. (Germany, F.R.); GKSS-Forschungszentrum Geesthacht G.m.b.H., Geesthacht-Tesperhude (Germany, F.R.). Inst. fuer Physik). 1987. 118p. (In German). NTIS (US Sales Only), PC A06/MF A01. Order Number DE88751491/JAW.

A position sensitive multiwire proportional counter has been developed for applications in neutron radiography and small angle neutron scattering experiments. Its sensitivity for thermal neutrons is about 50% and its spatial resolution was measured to be 5,7 mm (anode) resp. 7,9 mm (cathode). The maximal counting rate for the applied electronic system comes up to about 2 . 10/sup 4/ s/sup -1/ . By means of a simplified physical model the gamma sensitivity as well as the neutron sensitivity has been calculated taking into account the energy level of discrimination. Some applications for neutron radiography demonstrate the feasibility of this position sensitive counter. With 31 figs., 4 tabs..

9377 (GSI—87-12) Erection and testing of a magnet spectrometer for the velocity filter SHIP. Berthes, G. (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.); Mainz Univ. (Germany, F.R.)). Jul 1987. 101p. (In German). NTIS (US Sales Only), PC A06/MF A01. Order Number DE88751007/JAW.

In the framework of the present thesis a magnet spectrometer for the separation of heavy ions was constructed, erected, and tested. In connection with the velocity filter SHIP of GSI Darmstadt, the spectrometer consisting of a 30/sup 0/ dipole magnet and a quadrupole doublet can be used as recoil-product mass separator. As independent device with large acceptance the DQQ spectrometer can also be used with gas filling for instance for the producion of most heavy elements. The difference of the new arrangement to the hitherto operation of SHIP is that hitherto all products from fusion-evaporation reactions should be separated as possible, but now the separation of single isobaric chains for instance for detailed spectroscopy in the range of light and medium heavy nuclei is possible. An important range of application of the separator is the study of extremeously neutron-deficient nuclei with half-lives from μs to ms in regions in which the production cross sections strongly decrease with increasing neutron evaporation. The expected ion-optical properties of the DQQ spectrometer which were obtained by computer simulation of fusion experiments could be experimentally confirmed in the mass ranges around A=150 and A=100. In first applications it was shown that the methods of the in-beam spectroscopy and those of the on-line mass separators can be supplemented in the ranges of small formation cross sections and short-lived activities. By direct mass-number determination succeeded the unique assignment of the 109 μs respectively 33 μs proton activities to the masses A=109 and A=113. An α decay of the /sup 109/I could be excluded up to α branching ratios of less 1.10/sup -3/. A proton decay of the /sup 105/Sb could be excluded by a measurement up to limiting cross sections below 1 μb in the energy range from 460 keV to 770 keV.

9378 (IFVE-OEF—86-218) Gated wire photodetektor for electron high-flux operation. Buzulutskov, A.F.; Vasil'chenko, V.G.; Turchanovich, L.K. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1986. 8p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88700863/JAW.

Submitted to the journals NIM and Prib. Tekh. Ehksp. .

A method to gate the wire gas discharge photodetector with electrical and fibre-optical readout has been investigated. No restrictions due to positive space-charge effects have been revealed in the flux range up to 5x10/sup 5/ p.photoelectron./mmxs per anode wire. In the fibre-optical readout the hodoscope photomultipliers are used for the light detection at the fibre exits. In this case a coordinate resolution along the anode wire makes up 3mm. 11 refs.; 5 figs.

9379 (IFVE-OEF—86-225) Characteristics of hadronic showers detected by means of Cherenkov radiation in lead glass. Bitsadze, G.S.; Blik, A.M.; Kolosov, V.N. and others. (Joint Inst. for Nuclear Research, Dubna, USSR). (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1986. 11p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88700864/JAW.

Submitted to the journals Instru m. Exp. Tech. and NIM.

Space and energy characteristics of hadron showers were studied for the first time with the help of the total hadron absorption detector made from the lead glass. The calorimeter having longitudinal and transverse hodoscopic structure with 10 cm step is exposed to particle beam e/sup +/, μ/sup +/, π/sup +/, K/sup +/ , p at 5, 10 and 13 GeV/c. The data on the energy and coordinate resolution, hadron and electromagnetic shower separation have been obtained. 6 refs.; 7 figs.; 4 tabs.

9380 (INFN/TC—87-9) Automatic test system for the L3 muon drift chamber amplifiers. Bove, A.; Caiazzo, L.; Lanzano, S.; Manna, F.; Manto, G.; Parascandolo, L.; Parascandolo, P.; Parmentola, A.; Paternoster, G. (Istituto Nazionale di Fisica Nucleare, Bari (Italy)). 1987. 15p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88700769/JAW.

We describe the system we developed to test the linearity of wire chambers amplifiers of the muon spectrometer presently in construction for the L3 experiment at LEP. The system, controlled by an Apple II computer, is capable of localizing both defective components and faults in the printed board. It will be used to perform the large scale quality control of the amplifier cards.

9381 (INFN/TC—87-10) Converting structures to optimize the Synchrotron X radiation detection by CCD systems. Zanella, G.; Zannoni, R. (Istituto Nazionale di Fisica Nucleare, Bari (Italy)). 1987. 6p. (In Italian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88700770/JAW.

It is pointed out how the quantum efficiency of X ray detection for CCD detecting system can be improved enlarging their sensivity range by means of heavy element converting structures. So the problem of fabricating CCD with a deep emptying layer is avoided.

9382 (INIS-mf—10798) Arrangement of an experiment for the measurement of the polarization-transfer coefficient D/sub t/ in the neutron-proton scattering. Wollmann, G. (Bonn Univ. (Germany, F.R.). Mathematisch-Naturwissenschaftliche Fakultaet). 19 Dec 1986. 107p. (In German). NTIS (US Sales Only), PC A06/MF A01. Order Number DE88751523/JAW.

The present thesis describes an apparative arrangement for the measurement of the n-p polarization-transfer coefficient D/sub t/ at a mean neutron energy of 25.5 MeV and the possibility for the determination of the /sup 3/S/sub 1/-/sup 3/D/sub 1/ mixing parameter. Extensive Monte Carlo programs were developed for the optimization of the experimental arrangement and for the determination of the polarimeter properties. An unpolarized test measure-

ment is presented as well as the course of the data evaluation discussed. A first polarized measurement yielded because of a cup current of only 30 nA as well as some technical problems at the isochronous cyclotron yet no evident result concerning D/sub t/. At a polarized beam current of 500 nA to be expected and a mean neutron polarization of P/sub n/=0.45 the n-p polarization-transfer coefficient D/sub t/ can be determined in a four-week beam-time to +-0.025 from which a fixation of the /sup 3/S/sub 1/-/sup 3/D/sub 1/ mixing parameter to +-1.0 degrees results.

9383 (INIS-mf—11048, pp 178) **Possibilities for making large plastic air-equivalent scintillators for low dose gamma rays measurement.** Donchev, S.; Miloslavov, V. Oct 1985. (In Bulgarian). NTIS (US Sales Only), PC A09/MF A01. Order Number DE88780035/JAW. (CONF-8510479—).

From 6. national congress of roentgenology, radiology and radiobiology; Sofia, Bulgaria (4 Oct 1985).

9384 (INIS-mf—11048, pp 186) **Dosimetric measurements with some lyoluminofores.** Doncheva, B.; Filev, G.; Trajkov, A. (Meditsinska Akademiya, Sofia, Bulgaria. Nauchen Inst. po Rentgenologiya i Radiobiologiya). Oct 1985. (In Bulgarian). NTIS (US Sales Only), PC A09/MF A01. Order Number DE88780035/JAW. (CONF-8510479—).

From 6. national congress of roentgenology, radiology and radiobiology; Sofia, Bulgaria (4 Oct 1985).

9385 (INIS-mf—11052, pp vp) **Present state and prospects of automated measurement and data processing in low energy physics.** Tsupko-Sitnikov, V.M. (Joint Inst. for Nuclear Research, Dubna, USSR). 1985. (In Russian). NTIS (US Sales Only), PC A19/MF A01. Order Number DE88700667/JAW. (CONF-8509430—).

From International summer school on hyperfine interactions and international study meeting: physics with oriented nuclei; Bechyne, Czechoslovakia (2 Sep 1985).

9386 (INIS-mf—11054, pp 39) **Fast analog-to-digital converter with time measurement option.** Pernicka, M.; Schmiedmayer, J. (Oesterreichische Akademie der Wissenschaften, Vienna. Inst. fuer Hochenergiephysik; Technische Univ., Vienna, Austria). Sep 1987. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88700772/JAW. (CONF-8709196—).

From Annual convention fo the Austrian Physical Society; Vienna, Austria (21 Sep 1987).

9387 (INIS-mf—11054, pp 48) **Neutron small-angle scattering on metal-hydrogen systems.** Miksovsky, A.; Rauch, H.; Seidl, E. (Atominstitut der Oesterreichischen Universitaeten, Vienna). Sep 1987. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88700772/JAW. (CONF-8709196—).

From Annual convention fo the Austrian Physical Society; Vienna, Austria (21 Sep 1987).

9388 (INIS-mf—11054, pp 49) **HF-gradient-spinflipper for coherent neutron energy shift.** Weinfurter, H.; Badurek, G.; Rauch, H. (Atominstitut der Oesterreichischen Universitaeten, Vienna). Sep 1987. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88700772/JAW. (CONF-8709196—).

From Annual convention fo the Austrian Physical Society; Vienna, Austria (21 Sep 1987).

9389 (INIS-mf—11054, pp 49) **Christiansen filter in the neutron interferometer.** Tuppinger, D.; Rauch, H. (Atominstitut der Oesterreichischen Universitaeten, Vienna). Sep 1987. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88700772/JAW. (CONF-8709196—).

From Annual convention fo the Austrian Physical Society; Vienna, Austria (21 Sep 1987).

9390 (INIS-mf—11054, pp 51) **Neutron depolarization in magnetic materials.** Veider, A.; Badurek, G.; Groessinger, R. (Technische Univ., Vienna, Austria; Technische Univ., Vienna, Austria. Inst. fuer Experimentalphysik). Sep 1987. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88700772/JAW. (CONF-8709196—).

From Annual convention fo the Austrian Physical Society; Vienna, Austria (21 Sep 1987).

9391 (INIS-mf—11054, pp 51) **Neutron diffractometry in strong magnetic fields.** Gigler, C.; Badurek, G.; Groessinger, R. (Technische Univ., Vienna, Austria; Technische Univ., Vienna, Austria. Inst. fuer Experimentalphysik). Sep 1987. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88700772/JAW. (CONF-8709196—).

From Annual convention fo the Austrian Physical Society; Vienna, Austria (21 Sep 1987).

9392 (INIS-mf—11054, pp 40) **Experiment DELPHI at the LEP ring.** Adam, W.; Bartl, W.; Fruehwirth, R.; Hrubec, J.; Leder, G.; Mandl, F.; Mitaroff, W.; Pernicka, M.; Regler, M. (Oesterreichische Akademie der Wissenschaften, Vienna. Inst. fuer Hochenergiephysik). Sep 1987. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88700772/JAW. (CONF-8709196—).

From Annual convention fo the Austrian Physical Society; Vienna, Austria (21 Sep 1987).

9393 **(ITEF—18-1986) Analytical method for determination of topographical correction during electron energy measurement for a hodoscopic shower Cherenkov spectrometer.** Balats, M.Ya.; Vishnyakov, V.E.; Dzyubenko, G.B. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1986. 24p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88700441/JAW.

Analytical dependence of topographical correction for measured electron energy or for electron-positron shower on the incident angle and input coordinates is obtained for a hodoscopic shower Cherenkov spectrometer. The accuracy of the energy restoration by the described method is (2-3)%. 1 ref.; 14 figs.

9394 **(JINR—13-86-738) Programmable track processors in BIS-2 spectrometer.** Aref'ev, V.A.; Gus'kov, B.N.; Evsikov, I.I. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy). 1986. 14p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88700472/JAW.

PR1 and PR2 programmable track processors and their application in BIS-2 spectrometer for event selection by the number of direct tracks are described. Information on an event is read out from three or five planes of proportional chambers. Search for tracks of charged particles produced in neutron-nucleus interactions is fulfilled inside a region limited by target size and hit wire coordinate in the base chamber. Time of decision including the information readout electronics into processor memory is about 3 ms for PR1 and 1 ms for PR2. Application of these procesors in the experiment enhances signal/background ratio by a factor of 1.3 for PR1 and 1.45 for PR2 processors. 6 refs.; 8 figs.; 3 tabs.

9395 **(JINR—13-86-796) Semiconductor detectors with thin dead layers produced by lithium diffusion.** Gornov, M.G.; Gurov, Yu.B.; Kim Zaj Te. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems). 1986. 6p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88700474/JAW.

Submitted to the journal Instrum. Exp. Tech. .

The semiconductor detectors (SD) with thin (10-20 mkm) "dead" layers are described which allow to approach the energy resolution of SD spectrometers to summary resolution of detectors. In order to diminish the depth of p-n transition junction, as compared to traditional technology, the lithium diffusion is performed by means of light pulses at temperature gradient in a sample. Besides, in such an approach the surface impurity concentration in-

creases that results in improvement of contact qualities, and as a consequence, the detector characteristics improve. 8 refs.; 5 figs.; 1 tab.

9396 **(JINR—13-86-817) Design of a vertex detector from four cylindrical chambers.** Travkin, V.I. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems). 1986. 6p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88700475/JAW.

Submitted to the journal Instrum. Exp. Tech. .

A design of a vertex detector consisting of 4 cylindrical chambers is described. The base element of each chamber is a polyurethane-foam tybe. The length of the sensitive layer in a chamber is 760 mm. The diameter of the internal chamber is 143 mm, the outer diameter is 461 mm. Each chamber allows detecting two coordinates of a particle by the number of the anode wire operated and by distribution of the charge induced in the cathode. The amount of substance in the way of particles moving radially from the axis is ≦ 1.5 g/cm/sup 2/. The anode-cathode gap in the four chambers is made with an accuracy not worse than that of the machine-tool, which is +-0.05 mm. Cylindricity of the induction cathode did not exceed 0.2 mm. The accuracy of the anode-cathode gap is +-0.1 mm. The vertex detector has 340 channels to measure the longitudinal coordinate and 512 channels to measure the azimuthal coordinate. Beam tests at the IHEP accelerator showed that technological and designed accuracies are correct. 4 refs.; 1 fig.; 1 tab.

9397 **(JINR—13-87-91) Gas-discharge particle detector with ball-tipped anodes.** Travkin, V.I.; Khazins, D.M. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems). 1987. 6p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88700900/JAW.

Submitted to the journal Nucl. Instrum. Methods.

A new gas-discharge particle detector, whose anode is a set of balls 2mm in diameter is investigated. The chamber is blowing down by the argon-methane-methylal gas mixture with the ratio 3:1:1. The detector operates in the self-quenching streamer mode, has high efficiency and a wide counting characteristic plateau. The maximum counting rate of particles at one ball is ~ 2.5x10/sup 4/ s/sup -1/. The ball-tipped anodes allow making reliable complex-shaped detectors. Two-coordinate detection of multiparticle events can be naturally organized in detectors like that. 9 refs.; 4 figs.

9398 **(JINR—18-86-788) Investigation of charged particle etching process in polyarylates.** Apel', P.Yu.; Titova, Sh.A.; Tret'yakova, S.P. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Reactions). 1986. 10p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88700476/JAW.

The etching of heavy ion tracks in three types of polyarylates has been investigated. The chemical treatment of the irradiated polyarylates was performed in aqueous and alcochol-aqueous solutions of alkali. The parameters of the etching process were studied as functions of temperature and composition of the etchant. The possibility of sensibilization of the tracks by means of gamma-irradiation and ultraviolet exposure has been examined. The threshold for the registration of heavy charged particles in polyarylates has been found to equal ca. 3 MeV cm/sup 2//mg. 13 refs.; 10 figs.

9399 **(JINR—E-13-86-501) Time-zero detector based on microchannel plates and a friable dielectric emitter.** Luk'yanov, S.M.; Lewitowicz, M.; Penionzhkevich, Yu.E.; Chubaryan, G.G.; Bazin, D.; Guillemaud-Mueller, D.; Mueller, A.C.; Saint-Laurent, M.G. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Reactions). 1986. 7p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88700495/JAW.

A time-zero detector using a friable dielectric emitter and isochronous transport of secondary electrons onto a chevron device is described. The detector is intended to obtain time mark for time-of-flight method which is ised to determine the mass of heavy-ion reaction products. Test results of time resolution for detection on / sup 16/O beam with 50 MeV/nucleon energy from the GANIL accelerating complex (France) is given. 10 refs.; 4 figs.

9400 **(JINR-E—13-87-175) Magnetic field influence on the selfquenching streamer discharge.** Alekseev, G.D.; Korytov, A.V. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems). 1987. 8p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88700906/JAW.

Submitted to the journal NIM.

The influence of the magnetic field on the selfquenching streamer discharge characteristics is investigated. In the field about 10 kGs streamer charge is decreased several per cent (change of charge is due to amplitude decreasing of signal). In the transition region from limited-proportional to streamer mode magnetic field results in increasing of probability of avalanche developing into a streamer. 3 refs.; 8 figs.

9401 **(JINR-R—10-86-831) Simple method for separation of relativistic nuclear reaction fragments by their electrical charge.** Slovinskij, B.; Mulas, Eh.; Zhmyrov, V.N. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Computing Techniques and Automation). 1986. 7p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88700927/JAW.

Simple and effective criterion for separation by electric charge of relativistic particles registered by a set of scintillation counters is proposed. This criterion of aceraged amplitude is weakly sensitive to change in counter mode of operation and gives a possibility to separate particles on the significance level of about 10/sup -4/-10/sup -5/. The effect of the criterion is illustrated using inclusive spectra of relativistic fragments from the reaction of α-particles with light atomic nuclei obtained by means of the MASPIK magnetic spectrometer. 10 refs.; 2 figs.; 2 tabs.

9402 **(JINR-R—10-86-832) Separation of relativistic particles by their electric charge using ω/sup 2/ statistics.** Slovinskij, B.; Mulas, Eh.; Zhmyrov, V.N. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Computing Techniques and Automation). 1986. 5p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88700928/JAW.

The ω/sup 2/ statistics is used to separate by electric charges the relativistic nuclear fragments detected by a set of 5 scintillation counters of the MASPIC magnetic spectrometer. Estimations of significance level for the hypothesis Z=1 and probabilities to take a particle with Z=2 for a one having the charge Z=1 have been performed. Numerical results are obtained using experimental data concerning reactions of α-particles with light nuclei at 4.5 GeV/c/N. 5 refs.; 3 figs.; 1 tab.

9403 **(JINR-R—13-87-17) Measuring module for experimental investigations with polarized neutrons and nuclei. Apparatus.** Boja, J.; Vagov, V.A.; Zhukov, G.P.; Rubin, D.; Khrykin, A.S. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Neutron Physics). 1987. 10p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88700930/JAW.

The automatic system for servicing experimental investigations with polarized neutrons and nuclei is described. It consists of the SM-3 mini-computer and CAMAC equipment. The system permits to store a few time-of-flight spectra simultaneously, and to control the experimental set-up, as well as to control experimental conditions and to analyse the accumulated spectra. 16 refs.; 5 figs.

9404 (KEK—86-13, pp 176-188) **Feasibility study of a compact detector for e/sup +/e/sup -/ colliding beam experiments at TRISTAN accumulator ring.** Kobayashi, Masaaki. (National Lab. for High Energy Physics, Oho, Ibaraki, Japan). Mar 1987. NTIS (US Sales Only), PC A09/MF A01. Order Number DE88780031/JAW. (CONF-8701101—).

From Symposium on hadron spectroscopy; Oho, Ibaraki, Japan (8 Jan 1987).

Interesting physics goals at AR experiments are briefly discussed with emphasis on B anti B mixing and CP Violation. With compactness and high capability for physics research as a guideline, a detector design is presented with characteristic features of preci-

sion EM calorimeter with full segmentation in both transverse and longitudinal directions, good lepton/hadron separation, π deg/γ separation, and good K/π separation based on precision TOF measurement.

9405 **(LBL—24183) High P/sub T/ detectors for the SSC.** Trilling, G.H. (Lawrence Berkeley Lab., CA (USA)). Nov 1987. Contract AC03-76SF00098. 14p. (CONF-8708186—2). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88002760/JAW.

From Workshop on detector simulation for the SSC; Argonne, IL, USA (24 Aug 1987).

Summarized in this report is some of the work done at the recent Workshop on Experiments, Detectors, and Experimental Areas for the Supercollider held at Berkeley. The major goal was to develop an understanding of what complement of detectors would provide the capability for a well-balanced physics program at the SSC. Unlike earlier studies which had emphasized individual components such as tracking, calorimetry, etc., the intention was to focus on complete detectors. The particular detectors discussed in this paper are: the large solenoid detectors, the compact solenoid detectors, the non-magnetic detectors, the dipole detectors and muon detectors. 10 refs., 6 figs., 2 tabs. (LSP)

9406 **(LPC—87-01) Distortionless bi-dimensional localization on a resistive plane: a pure hardware way.** Marechal, B.; Souza, M.N.; Froissart, M.; Dawson, R.B. (Cidade Universitaria, Rio de Janeiro, Brazil). (College de France, 75 - Paris. Lab. de Physique Corpusculaire). 1987. 54p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE88751759/JAW.

FR Patent 8617744/A/ (18 Dec 1986).

A new approach to the image distortion problem arising in bi-dimensional event localization on resistive planes is presented. Theoretical considerations lead to the proposed solution which consists in the multiplication of the pick-up electrodes and a suitable subsequent mixing of the output currents by means of discrete resistors. Experimental results exhibit image practically distortionfree over more than 80% of the resistive area without any software treatment of the data. Submillimetric spatial resolution is easily achieved.

9407 **(LPC-T—86-01) I. Simulation of a fast trigger using the time projection chamber of Delphi experiment at Cern. II. Selection of events e/sup +/e/sup -/ -> tantit (in Delphi) at the Z/sup 0/ pole.** Delikaris, D. (College de France, 75 - Paris. Lab. de Physique Corpusculaire). Apr 1986. 184p. (In French). NTIS (US Sales Only), PC A09/MF A01. Order Number DE88751762/JAW.

Three different aspects are reviewed in this work with the follow subjects: in the first part we propose a review of the possible physics at the Z/sup 0/ pole in the e/sup +/e/sup -/(LEP) collider at CERN. After that we give a detailed description of the Delphi detector used for the work presented here. The second part contains the study and the simulation of a fast trigger (35μs) using the TPC of Delphi. Parameters concerning the selection of real events and the rejection of the background are introduced to estimate the trigger's efficiency. At last, in the third part we propose a discrimination method based on a multidimensional analysis, for the t (top) events selection at the Z/sup 0/ energy, using generated events from the Lund Monte-Carlo. Using the Delphi detector we introduce constraints of detection, in view to obtain realistic events for the simulation.

9408 **(MPI-PAE/Exp.El.—178) Low noise - low power monolithic multiplexing readout electronics for silicon strip detectors.** Buttler, W.; Manfredi, P.F.; Lutz, G.; Bergmann, H.; Hauff, D.; Holl, P. (Max-Planck-Institut fuer Physik und Astrophysik, Muenchen (Germany, F.R.). Werner-Heisenberg-Inst. fuer Physik; Pavia Univ. (Italy)). Jul 1987. 16p. (CONF-870632—). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88751032/JAW.

From International Europhysics conference on high energy physics; Uppsala, Sweden (25 Jun 1987).

A 128 channel readout chip suitable for readout with 50 μm pitch has been developed in CMOS technology. It provides signal amplification, parallel data storage and serial readout. Switched capacitor technique is used for noise reduction by multi correlated sampling and simultaneously for second stage amplification. Power consumption is controlled by an externally applied reference voltage thereby allowing for an optimization of speed and noise versus power consumption for the individual needs of the particular experiment. Pulsed mode operation for further reduction of heat dissipation is easily possible without cutting the supply voltages. Very good noise performance (250+45.C/sub D/[pF] electrons) low input impedance (C/sub eff/ $>$ 200 pF) and large amplification (70 mV/fC) have been obtained at very low power consumption (1.6 mW per channel). The chip may be used for both synchronous (e.g. collider) and asynchronous (fixed target) applications where the time of the event is not known in advance. A second version with only 64 channels suitable for 100 μm pitch is in preparation. Further developments presently under way include the introduction of combined CMOS-JFET technology.

9409 **(PITHA—86-07) Determination of the physical parameters of a drift chamber by application of an UV laser as track producing source.** Hofmann, K.D. (Technische Hochschule Aachen (Germany, F.R.). Lehrstuhl fuer Experimentalphysik 3B und 3. Physikalisches Inst.). Nov 1986. 70p. (In German). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88751533/JAW.

For simple drift cells with a rotational-symmetric electric field the simulation of particle tracks by UV laser-radiation allows the exact determination of the position-drift time relation and the drift velocity in dependence on the drift path. For this the laser ionization density must be fitted to the ionization density for particles. Then the results are comparable with those reached at DESY. In the medium drift region spatial resolutions of 40 μm to 50 μm can be reached. An increase of the pressure to 2 bar absolute improves the spatial resolution especially for short drift paths ($\simeq$ 30 μm). A double-track simulation is possible by relatively simple means. The values reached with electrons however are not reached completely. With a more sophisticated beam optic and a smaller beam aperture particle tracks can be simulated more accurately. Also the evaluation procedures for the FADC data can be optimized in so far that the time resolution of the FADC's is comparable with that of the TDC's. The spatial resolutions calculated by this procedure agree with those determined from TDC data.

9410 **(RAL—85-112) HRPD: the high resolution powder diffractometer at the SNS.** Johnson, M.W.; David, W.I.F. (Rutherford Appleton Lab., Chilton (UK)). Dec 1985. 23p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88750690/JAW.

The paper concerns the high resolution powder diffractometer at the SNS. The instrument specifications with respect to: design, moderator, guide, choppers and sample tank/detectors, are all described. The predicted performances of the instrument, in term of resolution, intensity and background, are also given.

9411 **(RAL—86-019) ISIS time focussed crystal analyser spectrometer, TFXA.** Penfold, J.; Tomkinson, J. (Rutherford Appleton Lab., Chilton (UK)). Feb 1986. 20p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88750691/JAW.

The design and performance of a time focussed crystal analyser spectrometer, which has been installed on the ISIS spallation neutron source, is presented. The combination of time and energy focussing provides good (approx. 2 to 3%) energy transfer resolution over a wide range of energy transfers (10 to 500 meV). Initial results from zirconium hydride and potassium hydrogen maleate demonstrate clearly the good energy transfer resolution, and show an excellent signal to noise ratio.

9412 **(RAL—86-026) PRISMA - a spectrometer for the measurement of coherent excitations on a pulsed spallation neutron source.** Andreani, C.; Carlile, C.J.; Stirling, G.C.; Cilloco, F.; Petrillo, C.; Sacchetti, F.; Windsor, C.G. (Rutherford Appleton Lab., Chilton (UK)). Apr 1986. 23p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88750712/JAW.

To be submitted to Nuclear Instruments and Methods.

The measurement of nuclear and magnetic excitation spectra from single crystal samples remains central to condensed matter physics. The requirements in terms of the range and resolution of the scattering vector Q and energy transfer $h/2\pi\omega$ are reviewed and typical experiments with a well defined cross-section are chosen. The performance and limitations of existing instruments are reviewed. A design for a new spectrometer, PRISMA, to be installed on the UK spallation neutron source, ISIS, is presented. Its performance for chosen experiments is given in terms of the Q and $h/2\pi\omega$ range covered in a single scan, the resolution and the count rate.

9413 **(RAL—87-063) Matching condition for optimum thermal noise performance of F.E.T. charge amplifiers.** Seller, P. (Rutherford Appleton Lab., Chilton (UK)). Sep 1987. 10p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88751648/JAW.

Amplifiers in the charge amplifier configuration are being used extensively in the readout of solid state detectors. The majority of these amplifiers are built using a Field Effect Transistor input device. To achieve optimum noise performance, there is an important matching condition between the capacitance of the amplifier input device and that of the detector. In the paper, the matching condition is derived and the consequences are discussed.

9414 **(SIS—1987:8) Quality assurance in X-ray diagnostic radiology - Report I. Control programme.** Fosmark, H.; Rozycki, Z. (Statens Inst. for Straalehygiene, Oslo Norway; National Institute of Hygiene, Warsaw PL). (Statens Inst. for Straalehygiene, Oslo (Norway)). 1987. 26p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88751481/JAW.

In the context of an analysis of technical quality assurance in Norwegian X-ray departments, a survey has been carried out in 21 laboratories in 4 hospitals. The tests were restricted to equipment used in general radiography, and the parameters analysed were of kV (using an electronic penetrameter), exposure time, waveform, output and automatic exposure control systems. In addition, a trial to compare overall performance in radiography and fluoroscopy was performed with a PMMP test phantom (SPRI). The survey is presented in two reports. This first one covers details of procedures and equipment. In the second report results are given and discussed. The results show that most of the equipment does function satifactorily, but also demonstrate the need to introduce quality assurance in X-ray departments.

9415 **(SIS—1987:9) Quality assurance in X-ray diagnostic radiology - Report II. Results.** Fosmark, H.; Rozycki, Z. (Statens Inst. for Straalehygiene, Oslo Norway; National Institute of Hygiene, Warsaw PL). (Statens Inst. for Straalehygiene, Oslo (Norway)). 1987. 39p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88751482/JAW.

In the context of an analysis of technical quality assurance in Norwegian X-ray departments, a survey has been carried out in 21 laboratories in 4 hospitals. The tests were restricted to equipment used in general radiography, and the parameters analysed were of kV (using an electronic penetrameter), exposure time, waveform, output and automatic exposure control systems. In addition, a trial to compare overall performance in radiography and fluoroscopy was performed with a PMMP test phantom (SPRI). The survey is presented in two reports. The first one covers details of procedures and equipment. In this second report results are given and discussed. The results show that most of the equipment does function satifactorily, but also demonstrate the need to introduce quality assurance in X-ray departments.

9416 **(SLAC-PUB—4404) Development of low noise preamplifier for the detection and position determination of single electrons in a Cerenkov Ring Imaging Detector by charge division.** Spencer, E.; Coyle, P.; Williams, D; Bienz, T.; Bird, F.; Gaillard, M.; Hallewell, G.; Kwon, Y.J.; Leith, D.; McShurley, D. (California Univ., Santa Cruz (USA); Stanford Linear Accelerator Center, Menlo Park, CA (USA); California Univ., Santa Barbara (USA); Cincinnati Univ., OH (USA)). Oct 1987. Contract AC03-76SF00515;AT03-76ER70023. 7p. (CONF-871006—17). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88003259/JAW.

From Nuclear science symposium; San Francisco, CA, USA (21 Oct 1987).

A preamplifier having 500 electrons noise (rms) has been developed for the detection and location of single electrons in a CRID detector at the SLD. A single channel contains preamp, RC-CR shaper, gain adjustment, driver, and calibration circuitry. Noise and linearity measurements are presented.

9417 **(SLAC-PUB—4470) Detector simulation needs for detector designers.** Hanson, G.G. (Stanford Linear Accelerator Center, Menlo Park, CA (USA)). Nov 1987. Contract AC03-76SF00515. 10p. (CONF-8708186—1). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88003604/JAW.

From Workshop on detector simulation for the SSC; Argonne, IL, USA (24 Aug 1987).

Computer simulation of the components of SSC detectors and of the complete detectors will be very important for the designs of the detectors. The ratio of events from interesting physics to events from background processes is very low, so detailed understanding of detector response to the backgrounds is needed. Any large detector for the SSC will be very complex and expensive and every effort must be made to design detectors which will have excellent performance and will not have to undergo major rebuilding. Some areas in which computer simulation is particularly needed are pattern recognition in tracking detectors and development of shower simulation code which can be trusted as an aid in the design and optimization of calorimeters, including their electron identification performance. Existing codes require too much computer time to be practical and need to be compared with test beam data at energies of several hundred GeV. Computer simulation of the processing of the data, including electronics response to the signals from the detector components, processing of the data by microprocessors on the detector, the trigger, and data acquisition will be required. In this report we discuss the detector simulation needs for detector designers.

9418 **Pulsed helium ionization detection system.** Ramsey, R.S.; Todd, R.A. (to Dept. of Energy, Washington, DC). US Patent 4,705,947. 10 Nov 1987. Filed date 9 Apr 1985. vp. Patent and Trademark Office, Box 9, Washington, DC 20232.

A pulsed helium ionization detection system is described comprising: an ionization detection chamber including anode and cathode electrodes between which helium carrier gas containing an ionizable component to be detected is introduced and an ionizing radiation source disposed within the chamber for ionizing only the component to be detected; ionization current sensing means for sensing and recording the magnitude of ionization current produced by the ionization of the component to be detected in the detection chamber as a direct indication of the concentration of the ionizable component introduced into the chamber; and a high voltage pulser means for generating and applying bias voltage pulses at selected frequencies over a range of from about 1 kHz to 333 kHz, amplitudes up to about 500 volts and duty cycles to produce a discontinuous ionization current output sensed by the ionization current sensing means.

9419 **Closed-loop pulsed helium ionization detector.** Ramsey, R.S.; Todd, R.A. (to Dept. of Energy, Washington, DC). US Patent 4,705,948. 10 Nov 1987. Filed date 24 Feb 1986. vp. Patent and Trademark Office, Box 9, Washington, DC 20232.

In combination, a helium ionization detector and a closed-loop control system for pulsed operation of the helium ionization detector is described comprising: a helium ionization detector having an anode and cathode electrodes between which a helium carrier gas containing an ionizable component whose concentration is to be detected is introduced to be ionized to produce an ionization current therein which flows through the electrodes when a high voltage bias is applied between the electrodes; a high voltage pulser means for generating and applying selected amplitude high voltage bias pulses; a reference current generator means for generating a selected reference current corresponding to a desired average ionization current in the detector; an electrometer circuit means for generating an output signal at an output terminal that varies in inverse proportion to the change in ionization current in the detector; a switching pulse generating means responsive to the output signal of the electrometer circuit means for generating and applying the switching pulses to the high voltage pulser means at a frequency and a selected duty cycle which maintains a constant average ionization current flowing in the detector; means for sensing the amplitude of the output of the electrometer circuit means as an indication of the concentration of the ionizable component being detected by the helium ionization detector.

9420 **Scintillation light transport and detection.** Gabriel, T.A.; Lillie, R.A. (Oak Ridge National Lab., TN, USA). *Nuclear Instruments and Methods in Physics Research;* **258**: No. 2, 242-245(1 Aug 1987). Contract AC05-84OR21400.

Also published as report ORNL/TM—10047.

The MORSE neutron gamma-ray transport code has been modified to allow for the transport of scintillation light. This modified code is used to analyze the light collection characteristics of a large liquid scintillator module (18x18x350 cm/sup 3/).

9421 **Response functions for bismuth germanate detectors.** Wender, S.A.; Auchampaugh, G.F.; Hsu, H.; Debevec, P.T.; LeBrun, S.F.; Hoblit, S.D. (Los Alamos National Lab., NM, USA; Illinois Univ., Urbana, USA). *Nuclear Instruments and Methods in Physics Research;* **258**: No. 2, 225-229(1 Aug 1987).

A method of calculating the line shape and absolute efficiency of a 7.6 cm by 7.6 cm bismuth germanate scintillator for incident γ-rays between 6 and 40 MeV has been developed. The computer code 'CYLTRAN' was used to calculate the energy deposited in the crystal, and the output of the code was smeared with an empirically determined resolution function. The results of these calculations are compared to pulse height spectra measured using monoenergetic photons. This technique should be applicable to a wide range of experimental geometries and scintillator types.

9422 **Effects of end plates on resolution of wire chambers.** Baker, B.R. (Stanford Linear Accelerator Center, CA, USA). *Nuclear Instruments and Methods in Physics Research;* **257**: No. 2, 139-144(15 Jun 1987). Contract AC03-76SF00515.

Resolution may be significantly degraded near conducting end plates of wire chambers. Simple analytical methods are used to estimate the field distortion and consequent changes in drift time.

9423 **Determination of the spin alignment in heavy-ion reactions with the spin spectrometer.** Honkanen, K.J.; Dilmanian, F.A.; Sarantites, D.G.; Sorensen, S.P. (Washington Univ., St. Louis, MO, USA. Dept. of Chemistry; Oak Ridge National Lab., TN, USA). *Nuclear Instruments and Methods in Physics Research;* **257**: No. 2, 233-243(15 Jun 1987). Contract AC02-76ER04052;AC05-84OR21400.

A detailed procedure is outlined that permits one to deduce the spin direction in heavy-ion fusion reactions on an event-by-event basis using data from the spin spectrometer at the Holifield Heavy Ion Research Facility of Oak Ridge National Laboratory. The parameters that govern the ability of the spin spectrometer in determining the spin direction, namely the γ-ray multiplicity, the multipolarity, the crystal-to-crystal scattering, and coincidence summing, are examined in detail. Removal of detectors from the complete spectrometer causes large misalignment in the deduced spin distributions. A procedure to correct for this induced misalignment based on local density distributions is presented. Some results from measurement of angular distributions of α-particles using the spin alignment method are also discussed.

9424 **Field tests of a tissue-equivalent beta survey meter.** Martz, D.E.; Johnson, L.O.; Rich, B.L.; Daniel, S.H. (Idaho National Engineering Lab., Idaho Falls, USA). *Radiation Protection Dosimetry;* **14**: No. 2, 117-121(1986). (CONF-8510185—).

From Workshop on dosimetry of beta particles and low energy X-rays; Paris, France (7 Oct 1985).

A tissue-equivalent survey meter for monitoring the (dD/dt)(0.07) and (dD/dt)(10) dose rates produced by betas and photons has been designed and tested. The very thin tissue-equivalent plastic scintillator closely simulates the critical skin tissue layer between 4 $mg.cm^{-2}$ and 9 $mg.cm^{-2}$. The meter is calibrated to read the (dD/dt)(0.07) dose rate directly, and the (dD/dt)(10) dose rate behind a filter. Laboratory measurements of calibrated sources and field tests have demonstrated tissue-equivalent response of the survey meter to betas between 70 keV and 2500 keV and to photons with energies greater than about 30 keV.

9425 **Measurement of beta spectra and dose in mixed beta-photon fields.** Hajnal, F. (Department of Energy, New York, USA. Environmental Measurements Lab.). *Radiation Protection Dosimetry;* **14**: No. 2, 175-178(1986). (CONF-8510185—).

From Workshop on dosimetry of beta particles and low energy X-rays; Paris, France (7 Oct 1985).

The development of a portable, phoswich-type, field beta spectrometer-dosemeter to measure beta spectra and doses at selected tissue depths in intense mixed beta-gamma radiation fields is described. The techniques used for the evaluation of the surface and depth dose rates based on beta spectral measurements are presented.

9426 **Portable beta spectrometer for tissue dose measurement.** Martz, D.E.; Rich, B.L.; Johnson, L.O. (Idaho National Engineering Lab., Idaho Falls, USA). *Radiation Protection Dosimetry;* **14**: No. 2, 183-186(1986). (CONF-8510185—).

From Workshop on dosimetry of beta particles and low energy X-rays; Paris, France (7 Oct 1985).

A technique for measuring the (dD/dt)(0.07) and (dD/dt)(10) dose rates in mixed beta/gamma radiation fields through the used of a tissue-equivalent detector and portable multichannel analyser has been developed and field tested. Two energy spectra are collected for each measurement, an open window spectrum representing the tissue response to betas plus photons, and a second filtered spectrum representing the photon response. A close approximation to the net beta spectrum is obtained by spectrum stripping, and the (dD/dt)(0.07) dose rate is calculated by multiplying, channel by channel, by a beta energy deposition function. Computer plots of typical field spectra and dose rate calculations are presented.

9427 **SSC trigger cross sections.** Paige, F.E. (Physics Dept., Brookhaven National Lab., Upton, NY 11973). pp 51-75 of Proceedings of the workshop on triggering, data acquisition and computing for high energy, high luminosity, hadron-hadron colliders. Cox, B.; Fenney, R.; Hale, P. Batavia, IL; Fermi National Accelerator Laboratory (1985). (CONF-8511150—). Contract AC02-76CH00016.

From Workshop on triggering, data acquisition and computing for high energy/high luminosity hadron-hadron colliders; Batavia, IL, USA (11 Nov 1985).

Most triggers at the SSC will involve multiple jets or jets plus leptons or missing rho/sub T/; cross sections for these are calculated. Events containing W/sup +/W/sup -/ pairs will be an important signature at the SSC and provide a good test of its trigger system. Properties of such events are given in this paper.

9428 BNL hypernuclear spectrometers and instrumentation present and future. Pile, P.H. (Brookhaven National Laboratory, Upton, New York, 11973, USA). *AIP (American Institute of Physics) Conference Proceedings;* **123**: No. 1, 813-818(15 Nov 1984). (CONF-8405193—). Contract AC02-76CH00016.

From Conference on the intersections between particle and nuclear physics; Steamboat Springs, CO, USA (23 May 1984).

During the period 1981 to 1984 the BNL hypernuclear spectrometer system was upgraded resulting in an increase in kaon flux and an increase in solid angle and momentum acceptance. The modifications require drift chambers to be operated at rates up to 10^7 s^{-1}. The performance of the spectrometer-drift chamber systems will be discussed.

4402 Radiation Effects On Instrument Components, Instruments, Or Electronic Systems

REFER ALSO TO CITATION(S) 9132

9429 (AERE-R—12578) Use of /sup 252/Cf for cosmic ray simulation. Sanderson, T.K. (UKAEA Atomic Energy Research Establishment, Harwell. Instrumentation and Applied Physics Div.). Jul 1987. 23p. H.M. Stationery Office, London, price Pound 4.00.

The report describes the use of /sup 252/Cf in the testing of VLSI electronic components for sensitivity to heavy ions. The source /sup 252/Cf emits alpha particles, fast neutrons and fission fragments in large numbers. The fission fragments are heavy ions which high LET makes them well suited for cosmic ray simulation experiments. The convenience and simplicity of the technique make it very attractive and have led to its widespread acceptance. The safety aspects of using a /sup 252/Cf source are considered and recommendations are made on the handling, calibration and use of the source.

4403 Miscellaneous Instruments

REFER ALSO TO CITATION(S) 9337, 9500

9430 (AERE-M—3413) User guide to stepper motor control on the HVL VAX 11/730: the horizontal sample changer, SAMPLE and subroutines. Thornton, R.P.; Parker, D.J. (UKAEA Atomic Energy Research Establishment, Harwell. Nuclear Physics Div.). Nov 1985. 31p. (HVL/VAX—004). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88750708/JAW.

This user guide describes the HVL Group automatic sample changer used with a horizontal Ge(Li) gamma-ray spectrometer at AERE Harwell, and its control program SAMPLE. An associated package of general purpose FORTRAN 77 subroutines for controlling stepper motors from the HVL VAX 11/730 computer via CAMAC electronics, and the manual control program REMOTE are also described.

9431 (IRD-CNEN-NT—009/87) Evaluation of a dark-room. Passos, J.C. (Instituto de Radioprotecao e Dosimetria, Rio de Janeiro (Brazil)). 1987. 19p. (In Portuguese). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88700438/JAW.

The adequate operation conditions of a dark-room are essential to guarantee the image quality, the least exposure of the patient and the staff, contributing also to reduce the expenses with specific equipments and processing solutions. Therefore, to install a dark-room, it is necessary a previous study about its physical dimensions, the location of equipments, accessories, light safeguards and visual warning, besides adequate darkening and correct filme processing. We propose three basic tests to check the adequacy and the integrity of a dark-room: light safeguards test, hygiene test, developing time and temperature test.

9432 (ITEF—58(1986)) Multichannel analog-to-digital converter. Semenov, A.L. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1986. 4p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88700887/JAW.

A multichannel unit of the analog-to-digital converter (ADC) designed for analog data acquisition and processing in physical experiments is described. The unit has 32 analog inputs with the aperture delay being not more than 100 ns. Bit capacity is 10 bits, time of transformation - 40 μs/channel. 2 refs.; 1 fig.

9433 (JINR—13-86-566) Failure-resistant fibre-optical communication line (FOCL). Romanov, Yu.I. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy). 1986. 7p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88700470/JAW.

A 3-channel failure-resistant apparatus for digital information transfer via fibre-optical communication lines (FOCL) is described. The FOCL channels are constructed according to the following circuit: an optical transmitter with paraphase output - a double-optical line - a different optical receiver. They are used for data transfer without applying coding over a range of frequencies from 0 to 100 kHz. The FOCL length is 10 m. The range of operating temperatures is +5...+45 deg C. 11 refs.; 4 figs.

9434 (ORNL/M—442) Explosives sensor. (Oak Ridge National Lab., TN (USA)). [1987]. Contract AC05-84OR21400. 8p. (ORNL/M—391). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88002811/JAW.

A compact and supersensitive device that can rapidly detect minute trace vapors from concealed explosives has been developed by scientists at Oak Ridge National Laboratory (ORNL). The new explosives sensor can detect and chemically identify organic nitrogen-oxygen compounds which are the building blocks of explosives such as TNT, plastiques, and nitroglycerine. The device could be used to scan persons entering airport terminals, nuclear power plants, defense installations, or other sensitive locations, providing greater security against potential terrorism. This device works on a glow discharge principle, and is more specifically called an "Atmospheric Sampling Glow Discharge Ionization" (ASGDI) source. The new detector is a highly automated, miniaturized version of research mass spectrometers widely used to trace constituents of chemical mixtures. Detail of this device's construction and advantages are discussed in this paper. 2 figs.

9435 (RAL—86-016) Powerful, low-cost histogramming memory for digital radiography with multi-wire proportional counters. Bateman, J.E.; Locke, C.E.R.; Ferrari, C.A. (Rutherford Appleton Lab., Chilton (UK)). 1986. 11p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88750710/JAW.

A powerful, low-cost histogramming memory for digital radiograph with multi-wire proportional counter is described. The memory is based on a commercial video display device coupled to an Apple II microcomputer which, at a total cost of around 2500 pounds gives a system with 512 x 512 pixel resolution and a counting range of 4095 counts per pixel. The system can take data at rates of up to 5000 Hz while providing a live-time display. No hardware modifications are necessary, the comprehensive storage and display facilities being implemented in a combined package of BASIC and ASSEMBLER software. An ACCELERATOR co-processor card is used to enhance the performance of the system.

9436 (UCRL—96319) Multi-component stress history measurements and analysis. Stout, R.B.; Larson, D.B. (Lawrence Livermore National Lab., CA (USA)). Aug 1987. Contract W-7405-ENG-48. 45p. (CONF-870961—4). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88000977/JAW.

From 4. symposium on containment of underground nuclear explosions; Colorado Springs, CO, USA (21 Sep 1987).

Piezoresistance foil gages were tested dynamically in multi-component stress-strain experiments in order that the actual shock wave conditions of underground nuclear testing could be more

closely simulated. The multi-component stress-strain histories were created in polymethylmethacrylate (PMMA) by using chemical explosions to generate spherical shock waves. In addition to the resistivity measurements from the foil gages, particle velocity was also measured at several radial positions from the explosion to provide a complete set of data for analysis. The gage interpretation (inverse) problem for multi-component stress-strain fields requires obtaining a sufficient number of independent measurements so that the different stress-strain components influencing the gage response can be uniquely inferred. The piezoresistance measurements provided data from a triple material foil gage and from ytterbium foil gages (bare gages). An analysis shows that the triple material gage containing foils of ytterbium, manganin, and constantan provided three independent resistivity measurements for the gage oriented in a perpendicular direction relative to the radial propagating shock front. An analysis of the ytterbium foil gages, which were tested in both perpendicular (normal) and parallel (tangential) directions relative to the radial shock front, show the resistivity responses from these two orientations are independent measurements. The results from the analyses of the gages compared well with experimental data. This analysis shows clearly that the material properties of the foil, the dimensions of the foil, and the material surrounding the foil greatly influence the total resistivity response of foil gages in a multi-component stress-strain field. 25 refs., 16 figs.

9437 **(UCRL—96565) Flat-field response and geometric distortion measurements of optical streak cameras.** Montgomery, D.S.; Drake, R.P.; Jones, B.A.; Wiedwald, J.D. (Lawrence Livermore National Lab., CA (USA)). Aug 1987. Contract W-7405-ENG-48. 8p. (CONF-8708110—28). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88002394/JAW.

From 31. SPIE annual international technical symposium on optical and optoelectronic applied science and engineering; San Diego, CA, USA (16 Aug 1987).

To accurately measure pulse amplitude, shape, and relative time histories of optical signals with an optical streak camera, it is necessary to correct each recorded image for spatially-dependent gain nonuniformity and geometric distortion. Gain nonuniformities arise from sensitivity variations in the streak-tube photocathode, phosphor screen, image-intensifier tube, and image recording system. These nonuniformities may be severe, and have been observed to be on the order of 100% for some LLNL optical streak cameras. Geometric distortion due to optical couplings, electron-optics, and sweep nonlinearity not only affects pulse position and timing measurements, but affects pulse amplitude and shape measurements as well. By using a 1.053-μm, long-pulse, high-power laser to generate a spatially and temporally uniform source as input to the streak camera, the combined effects of flat-field response and geometric distortion can be measured under the normal dynamic operation of cameras with S-1 photocathodes. Additionally, by using the same laser system to generate a train of short pulses that can be spatially modulated at the input of the streak camera, we can effectively create a two-dimensional grid of equally-spaced pulses. This allows a dynamic measurement of the geometric distortion of the streak camera. We will discuss the techniques involved in performing these calibrations, will present some of the measured results for LLNL optical streak cameras, and will discuss software methods to correct for these effects. 6 refs., 6 figs.

9438 **Liquid detection circuit.** Regan, T.O. (to Dept. of Energy, Washington, DC). US Patent 4,706,497. 17 Nov 1987. Filed date 1 Apr 1986. vp. Patent and Trademark Office, Box 9, Washington, DC 20232.

A circuit for detecting the presence of a liquid in a vessel is described. The circuit has a temperature sensitive resistance sensing element wherein it is self-protected from over heating. It consists of: a voltage amplifier means having an output and first and second inputs; a first voltage divider means having an input and an output, the output of the first voltage divider, coupled to the first input of the voltage amplifier means; a temperature sensitive resistance means whose resistance varies with temperature; a reference resistance means coupled in series with the temperature sensitive resistance means thereby forming a second voltage divider means having an input and an output; means for continuously limiting the direction of current flow to a single direction coupled between the output of the voltage amplifier and the inputs of both the first and second voltage dividers such that a feedback signal to the inputs of the voltage dividers is produced by the output of the voltage amplifier.

9439 **Method and apparatus relating to specimen cells for scanning electron microscopes.** Grimes, J.W.; Jennings, H.; Brown, P.W. (to Secretary of Commerce, Washington, DC). US Patent 4,705,949. 10 Nov 1987. Filed date 25 Nov 1985. vp. Patent and Trademark Office, Box 9, Washington, DC 20232.

An improved specimen cell for use in the evacuated chamber of a directed beam irradiation device having an electron beam is described comprising: means for preventing dehydration and disruption of a specimen placed in the cell including closed specimen means for mounting and at least partially containing the specimen; means for defining a single aperture between the specimen and the electron beam when the beam is directed towards the specimen, the aperture comprising a means, sized and geometrically configured, for bidirectionally passing electrons and for restricting passage of vapor from within to without the specimen means; and door means mounted on a pivotable arm for movement between an opened position and a closed position, for permitting bidirectional electron flow in the open position and for blocking the single aperture and for preventing passage of vapor from within to without the specimen means in the closed position. The door means comprise a backing metal plate attached to the arm and a facing of elastometric material for blocking the aperture.

9440 **High bandwidth applications of photonics.** Chang, J. (Diagnostics Div. 1234, Sandia National Labs., P.O. Box 5800, Albuquerque, NM 87185). pp 22-27 of Fiber optic and laser sensors III. Moore, E.L.; Ramer, O.G. Bellingham, WA; SPIE Society of Photo-Optical Instrumentation Engineers (1985). (CONF-850887—).

From SPIE international technical symposium on optical and electro-optical engineers; San Diego, CA, USA (18 Aug 1985).

High-bandwidth analog applications are a new and very promising area of photonics. Photonics is fast becoming the lead technology in the study of single-shot, rapid-transient phenomena because the photonic equivalent of a conventional diagnostic system offers unsurpassed performance and value.

9441 **Review of high bandwidth fiber optics radiation sensors.** Lyons, P.B. (Univ. of California, Los Alamos National Lab., P.O. Box 1663, MS E527, Los Alamos, NM 87545). pp 166-171 of Fiber optic and laser sensors III. Moore, E.L.; Ramer, O.G. Bellingham, WA; SPIE Society of Photo-Optical Instrumentation Engineers (1985). (CONF-850887—).

From SPIE international technical symposium on optical and electro-optical engineers; San Diego, CA, USA (18 Aug 1985).

This paper summarizes the use of fiber optics or guided optical systems for radiation sensors. It is limited to passive systems wherein electrical power is not required at the sensor location. However, electrically powered light sources, receivers and/or recorders may still be required for detection and data storage in sensor system operation. This paper emphasizes sensor technologies that permit high bandwidth measurements of transient radiation levels, and will also discuss several low bandwidth applications. In addition to discussion of several specific sensor concepts, an extensive bibliography is included to guide research into these, or other, forms of radiation sensors. The bibliography is subdivided into four major categories. In the bibliography, each paper is listed only once, even though a given paper may include data appropriate to several sections. Furthermore, to avoid long reference lists within the text, only a few of the bibliographical entries are referenced therein. The present conference is not included in the reference list, but includes several related papers.

9442 **Wideband optical fiber magnetic field sensor.** Martin, S.J.; Butler, M.A. (Sandia National Labs., Albuquerque, NM 87185). pp 197-200 of Fiber optic and laser sensors III. Moore, E.L.; Ramer, O.G. Bellingham, WA; SPIE Society of Photo-Optical Instrumentation Engineers (1985). (CONF-850887—). Contract AC04-76DP00789.

From SPIE international technical symposium on optical and electro-optical engineers; San Diego, CA, USA (18 Aug 1985).

Optical fibers using pure quartz or quartz doped with rare earth elements have been used as magnetic field sensors. In these sensors Faraday rotation of the optical polarization direction is used as the basis for measuring magnetic field strength. The angle of polarization rotation in the fiber is $\theta = BVL$, where B is magnetic field strength, V is the Verdet constant, and L is the propagation path length. Typically an analyzer is used after the fiber to convert polarization into intensity modulation. While it is convenient to use the optical fiber both as the telemetry link and as the sensing element, there are disadvantages associated with the latter. The small Verdet constant obtained in optical fibers requires a relatively long fiber to be used if a reasonable sensitivity is to be obtained. The large size of fiber sensors makes the measurement of localized fields difficult. Furthermore, the response time of an optical sensor is limited by the optical transit time so that long fiber sensors are intrinsically slow. Finally, magnetic field measurement is complicated by birefringence induced in the sensor at each fiber bend which leads to field independent polarization rotation.

9443 **Calibrated Faraday current and magnetic field sensor.** Neyer, B.T.; Chang, J.; Ruggles, L.E. (Diagnostics Div., 1234, Sandia National Labs., P.O. Box 5800, Albuquerque, NM 87185). pp 201-205 of Fiber optic and laser sensors III. Moore, E.L.; Ramer, O.G. Bellingham, WA; SPIE Society of Photo-Optical Instrumentation Engineers (1985). (CONF-850887—).

From SPIE international technical symposium on optical and electro-optical engineers; San Diego, CA, USA (18 Aug 1985).

The authors have developed a calibrated optical fiber Faraday rotation current sensor. A strong magnetic field in an optical fiber introduces circular birefringence, causing the plane of polarization of light to rotate by an amount proportional to the magnetic field. Faraday loops used in the past were nonlinear due to the stress-induced linear birefringence caused by bending the loop. This linear birefringence interfered with the Faraday rotation, yielding a complicated relationship between the current and detected light signal. They have found a way to overcome the effects of the unwanted linear birefringence and produce a calibrated current waveform. The calibration is limited only by the accurate knowledge of the Verdet constant of the optical fiber. Results of recent experiments as well as planned measurements are presented.

9444 **Measurement of Faraday rotation in twisted optical fiber using rotating polarization and analog phase detection.** Chandler, G.I.; Forman, P.R.; Jahoda, F.C. (Los Alamos National Lab., Mail Stop F639, Los Alamos, NM 87545). pp 206-211 of Fiber optic and laser sensors III. Moore, E.L.; Ramer, O.G. Bellingham, WA; SPIE Society of Photo-Optical Instrumentation Engineers (1985). (CONF-850887—).

From SPIE international technical symposium on optical and electro-optical engineers; San Diego, CA, USA (18 Aug 1985).

The authors demonstrate phase modulation of rotating linearly polarized light by current-induced Faraday rotation in a single mode optical fiber and used the technique to measure the current in ZT-40M, a Reversed-Field Pinch. They also demonstrate the practicality of using twisted sensing fiber to overcome the problems associated with linear birefringence.

9445 **Coupling between plastic scintillators and light fibers for remote detection of X-rays.** Perry, T.S.; Molitoris, J.J. (Lawrence Livermore National Lab., Univ. of California, P.O. Box 808, Livermore, CA 94550). pp 218-222 of Fiber optic and laser sensors III. Moore, E.L.; Ramer, O.G. Bellingham, WA; SPIE Society of Photo-Optical Instrumentation Engineers (1985). (CONF-850887—). Contract W-7405-ENG-48.

From SPIE international technical symposium on optical and electro-optical engineers; San Diego, CA, USA (18 Aug 1985).

Plastic scintillators can be coupled to light fibers to make small, simple, and inexpensive x-ray detectors. These detectors have been developed for use at the Nevada Test Site (NTS) for the remote detection of x-rays. Light produced in the scintillator can be transmitted by the fiber for several hundred meters to a photodetector, which is usually a streak camera or a photomultiplier tube. The use of a streak camera allows many channels to be recorded simultaneously. A parameter study has been done to measure the sensitivity of these detectors as a function of scintillator geometry, type of scintillator, coupling geometry, and x-ray energy. The results can be qualitatively explained by a simple geometric theory. A recent use of these detectors at NTS was the measurement of an x-ray spectrum. System performance for this measurement is reviewed.

9446 **Photonic measurements of microwave pulses.** Filter, W.F.; Chang, J.; Landron, C.O.; Muron, D.J. (Diagnostics Div. 1234, Sandia National Labs., Albuquerque, NM 87185). pp 227-232 of Fiber optic and laser sensors III. Moore, E.L.; Ramer, O.G. Bellingham, WA; SPIE Society of Photo-Optical Instrumentation Engineers (1985). (CONF-850887—). Contract AC04-76DP00789.

From SPIE international technical symposium on optical and electro-optical engineers; San Diego, CA, USA (18 Aug 1985).

The authors have successfully demonstrated a photonic free space microwave frequency sensor at the Sandia High Power Microwave facility. This sensor, which uses the Pockels effect, is a miniature dielectric device that they constructed from electro-optic and fiber-optic components. In this sensor, an incident pulsed microwave electric field modulates a carrier laser beam at the microwave frequency. The depth of modulation is proportional to the field strength. Since the bandwidth of the detected signal exceeds that of conventional transient signal digitizers, they use a prototype High Speed Multichannel Data Recorder that they have developed. This instrument employs a high bandwidth streak camera to record the sensor signal in real time, without the need for downmixing. Because it is small and dielectric, the sensor is non-perturbing. Its input and output leads are fiber-optic and therefore immune to electromagnetic interference. Because the sensor is broadband, the authors can Fourier transform the pulse and obtain a power spectrum. They discuss the construction and use of this sensor and present data showing the direct recording of a 3 GHz microwave pulse on the High Speed Multichannel Data Recorder. The authors also discuss the use of multigigahertz analog laser diode transmitters in extending the bandwidth of conventional pulsed microwave diagnostics.

45 EXPLOSIONS AND EXPLOSIVES

4501 Chemical

REFER ALSO TO CITATION(S) 9276, 9434, 9436

9447 **(SAND—87-2497C) Blast waves generated by planar detonations.** Thibault, P.A.; Penrose, J.D.; Shepherd, J.E.; Benedick, W.B.; Ritzel, D.V. (Sandia National Labs., Albuquerque, NM (USA); Combustion Dynamics Ltd., Medicine Hat, Alberta (Canada); Rensselaer Polytechnic Inst., Troy, NY (USA). Dept. of Mechanical Engineering, Aeronautical Engineering and Mechanics; Defence Research Establishment Suffield, Ralston, Alberta (Canada)). 1987. Contract AC04-76DP00789. 7p. (CONF-870737—4). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88002219/JAW.

From 16. shock tube symposium; Aachen, F.R. Germany (26 Jul 1987).

This paper presents experimental and theoretical studies of blast waves generated by gaseous and HE detonations in long cylindrical tubes. The experimental studies were performed using the 1.8 m diameter shock tube facilities at the Defence Research Establishment Suffield and at the New Mexico Engineering Research Institute. Two gaseous explosives, acetylene-oxygen and hydrogen-air, and one solid explosive, 120g nitroguanidine, were used in order to verify the validity of energy scaling in the far-field. The above experimental work is supported by one- and two-dimensional numerical computations which are based on the Flux Corrected Transport (FCT) algorithm. The experimental results are also analyzed in terms of a simple analytical blast model. 10 refs., 6 figs.

4502 Nuclear

REFER ALSO TO CITATION(S) 8870

4503 Explosion Detection

9448 **(DOE/DP/00789—T261) A high frequency seismic system for regional monitoring of NTS events: In-Country Seismic Verification Program.** Chael, E.; Kromer, R.; Patton, G.; Durham, J. (Sandia National Labs., Albuquerque, NM (USA)). 16 Apr 1987. Contract AC04-76DP00789. 12p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88002748/JAW.

A high frequency capability was recently added to the Nelson, Nevada, station of Sandia's Off-Site Seismic Network. Vertical ground motions over the 1 to 100 Hz frequency band can currently be monitored at three different gain levels. A high-gain channel records ambient background motions over this frequency band, and two lower gain channels are used to record the signals from nuclear tests on NTS. We present here some of the data collected from the first NTS shot monitored by the HF system, and follow this with a detailed description of the instrumentation.

50 ENVIRONMENTAL SCIENCES, ATMOSPHERIC

5001 Basic Studies

REFER ALSO TO CITATION(S) 9293

9449 **(GKSS—87/E/21) Radionuclides in environmental research and protection.** Michaelis, W. (GKSS-Forschungszentrum Geesthacht G.m.b.H., Geesthacht-Tesperhude (Germany, F.R.); GKSS-Forschungszentrum Geesthacht G.m.b.H., Geesthacht-Tesperhude (Germany, F.R.). Inst. fuer Physik). 1987. 10p. (CONF-8509412—). Also published in Isotopenpraxis (1986) v. 22(10) p. 337-344.

From 3. working meeting on radioisotope application and radiation processing in industry; Leipzig, German D.R. (23 Sep 1985).

Radioisotopes of both natural and artificial origin are widely used in environmental research and protection to tackle problems in which high specificity and sensitivity are required. The paper exemplifies the capabilities guided by some recent investigations in various fields of application: dating of river and marine sediments, determination of dry deposition rates for airborne particulates, studies of the uptake of organic compounds by plants and of the internal distribution processes in plants, investigation of transport phenomena in soil, groundwater or surface waters, development of trace analytical procedures, application of neutron activation analysis, detection of trace gases by means of ionization detectors, and the exploration of mud fields in tidal rivers using a radiometric density gauge.

9450 **Mesoscale boundary layer evolution over complex terrain. Part I: Numerical simulation of the diurnal cycle.** Bader, D.C.; McKee, T.B.; Tripoli, G.J. (Pacific Northwest Laboratory, Richland, WA 99352). *Journal of the Atmospheric Sciences;* **44**: No. 19, 2823-2838(1 Oct 1987). Contract AC06-76RL01830.

The continuous development of a meso-β-scale boundary layer over sloping terrain upwind of a high mountain barrier was simulated through a complete diurnal cycle using a nonhydrostatic boundary-layer model. The simulation detailed the evolution of a 500—800-m deep nocturnal boundary layer containing 1—3 m s^{-1} thermal circulations in the region upwind of a high ridge. Shear between the 5 m s^{-1} gradient level winds above the boundary layer and the mesoscale thermal circulations maintained the turbulent mixing of cold air upward against the stable stratification. The nocturnal boundary layer is replaced the following morning by a growing convective boundary layer containing 3—5 m s^{-1} warm thermal flows under its base. A multiple layer structure appears during the morning transition with the coexistence of the synoptic, nocturnal and developing daytime wind systems. As the morning progresses, the downwind edge of the stable layer slowly retreats back toward lower elevations while the convective layer grows under its base. By 5 h after sunrise, the morning transition is complete. Comparisons of the model simulation with field data show that the model accurately simulates the diurnal development of the mesoscale boundary layer.

9451 **Pollution possibility frontiers.** Kolstad, C.D. (Illinois Univ., Urbana, USA). pp 273-287 of Strategic planning in energy and natural resources. Lev, B.; Bloom, J.A.; Gleit, A.S.; Murphy, F.H.; Shoemaker, C. (eds.). Amsterdam, Netherlands; Elsevier Science Publishers B.V. (1987). (CONF-8604185—).

From 2. symposium on analytic techniques for energy, natural resources, and environmental planning; Philadelphia, PA, USA (3 Apr 1986).

The process of generating environmental externalities consists of three steps: industry generates residuals; residuals are transformed by the environment into ambient pollution; and pollution is 'consumed', producing disutility or damage. This paper is concerned with the transformation of residuals into ambient pollution, a subject that has received very little attention in the economics literature. It is showed how economic theory can be used to develop an aggregate relationship between residuals generation and ambient pollution in very much the same way that a production function summarizes engineering relationships of production. Restrictions on the functional form of such a pollution possibility frontier are developed. The frontier is estimated for the Petrified Forest region of Arizona.

5002 Chemicals Monitoring And Transport

REFER ALSO TO CITATION(S) 8443, 8771, 9006, 9451, 9919, 9921, 9926

9452 **(DOE/EV/01199—65) Study of atmospheric pollution scavenging: Twenty-first progress report.** Semonin, R.G.; Bowersox, V.C.; Stensland, G.J.; Peden, M.E.; Doty, K.G.; Gatz, D.F.; Lockard, J.M.; Bachman, S.R.; Skowron, L.M.; Su, J. (Illinois State Water Survey, Urbana (USA)). Jul 1987. Contract AC02-76EV01199. 336p. (COO—1199-65). NTIS, PC A15/MF A01; 1; GPO Dep. Order Number DE87012648/JAW.

Individual papers are processed separately for the data bases. (TEM)

9453 (DOE/EV/01199—65, pp 1-20) **Wet deposition chemistry.** Semonin, R.G. Jul 1987. NTIS, PC A15/MF A01. Order Number DE87012648/JAW.

In Study of atmospheric pollution scavenging: Twenty-first progress report.

The siting criteria, quality assurance, and standardized equipment and analytical methodology are addressed to insure the highest quality data for interpretive research. The national distribution of concentration and deposition for calcium, ammonium, chloride, nitrate, sulfate, and pH are shown in a series of maps. The maps show high concentrations of calcium and ammonium in the Great Plains, high concentrations of nitrate, sulfate, and hydrogen ion in the eastern states, and high concentrations of chloride along the coastal states. The primary conclusions are the greatest deposition is directly associated with the largest emission regions, and dry deposits are largely unknown, but clearly must be measured before the biochemical and geochemical cycles will be fully understood. 25 refs., 8 figs.

9454 (DOE/EV/01199—65, pp 21-37) **Intra-annual variations in the concentrations of major inorganic ions in the precipitation of the United States.** Bowersox, V.C.; Stensland, G.J. Jul 1987. NTIS, PC A15/MF A01. Order Number DE87012648/JAW.

In Study of atmospheric pollution scavenging: Twenty-first progress report.

The concentrations of the major inorganic ions in precipitation exhibit seasonal (3-month average) excursions at eastern US sampling locations. This study extends previous work by examining intra-annual variations in concentrations for all of the major inor-

ganic ions in both the western and eastern US. NADP/NTN data from October 1978 to March 1984 were used. Concentration ratios were calculated, where the ratio was either warm season concentration/cold season concentration or warm period concentration/cold period concentration. Seasons were 3-month intervals, while periods were 5-month intervals. The summer (warm) season was June, July, and August, while the winter (cold) season was December, January, and February. The summer (warm) period covered the 5-month interval from May through September, while the winter (cold) period covered the interval from November through March. For most of the US, the warm and cold periods approximated the growing seasons and dormant seasons, respectively. 15 refs., 16 figs., 1 tab.

9455 (DOE/EV/01199—65, pp 39-51) **Estimation of bias in the average wet deposition of calcium, sulfate, and sodium from National Atmospheric Deposition Program/National Trends Network (NADP/NTN) data.** Bowersox, V.C.; Stensland, G.J.; Peden, M.E. Jul 1987. NTIS, PC A15/MF A01. Order Number DE87012648/JAW.

In Study of atmospheric pollution scavenging: Twenty-first progress report.

In this study, estimates were made of the bias in Ca, Na, and SO_4 that resulted from the collection and handling of wet deposition samples in the NADP/NTN. The geographic patterns and relative importance of this bias to deposition from precipitation are demonstrated. Wet deposition data from 1978 to 1986 are available from the NADP/NTN Coordinator's Office. Quality assurance summaries that report on various measurements of bias and precision are now becoming available. Important sources of possible bias in the NADP/NTN system include analytical measurements, laboratory handling, the sampling container, a plastic (LPE) bucket, dust that enters the collection bucket while it is in the collector, but covered during dry weather (i.e., infiltration), and field handling. 12 refs., 7 figs.

9456 (DOE/EV/01199—65, pp 53-67) **Spatial relationships between acid rain, air quality, and visibility data.** Stensland, G.J. Jul 1987. NTIS, PC A15/MF A01. Order Number DE87012648/JAW.

In Study of atmospheric pollution scavenging: Twenty-first progress report.

Visibility and acid rain are two phenomena that both have direct relationships to air quality. This paper explores the relationships between three data sets, with emphasis on the situations for the eastern US. This paper presents interpretation of the most current precipitation chemistry data from the National Atmospheric Deposition Program/National Trends Network (NADP/NTN), which started in the eastern US in 1978 with less than 20 sites and continues today with over 200 sites spread across the entire US. The high site density and relatively long data record make the precipitation sulfate data particularly important. Spatial and seasonal maps and tables of sulfate in precipitation are compared to literature and unpublished values for visibility and air quality sulfate. Reasonable spatial and seasonal correspondence is found between precipitation sulfate and air quality sulfate. For visibility, the spatial pattern for coastal areas is not consistent with the precipitation sulfate pattern, presumably due to the effect of relative humidity. The seasonality pattern of visibility is not consistent with that for precipitation sulfate in Illinois, but is consistent for areas to the east. 17 refs., 4 figs., 2 tabs.

9457 (DOE/EV/01199—65, pp 69-80) **Variations in precipitation composition and deposition with synoptic weather type.** Doty, K.G.; Gatz, D.F. Jul 1987. NTIS, PC A15/MF A01. Order Number DE87012648/JAW.

In Study of atmospheric pollution scavenging: Twenty-first progress report.

The goal is to improve our ability to predict the locations and magnitudes of atmospheric wet deposition. As one portion of a broader analysis of five years of event precipitation chemistry data for central Illinois, we examined variations in ion composition and deposition with synoptic weather type to improve our scientific understanding of the chemical and physical mechanisms of scavenging and deposition of pollutants by precipitation. 8 figs., 1 tab.

9458 (DOE/EV/01199—65, pp 81-158) **Back trajectory climatologies for sulfate and nitrate wet deposition fluxes at a central Illinois site.** Doty, K.G.; Bowersox, V.C. Jul 1987. NTIS, PC A15/MF A01. Order Number DE87012648/JAW.

In Study of atmospheric pollution scavenging: Twenty-first progress report.

This chapter summarizes the results of the back trajectory calculations for flux classes utilizing the trajectory model (the ISWS model). This analysis involved approximately 250 precipitation chemistry samples and the calculation of about 1100 back trajectories 72 hours in length. Precipitation samples have been collected routinely since September 1979 at a field site in rural east-central Illinois. Samples were collected with automated wet-only collectors of the HASL design. To monitor operations, a raingage tandem to the collectors was installed to record the precipitation amount, time of occurrence, and the open/close status (i.e., event record) of the sample collection buckets on the collectors. Data from the gage were combined with the chemical concentration measurements of samples from the collectors to compute wet-only fluxes of sulfate and nitrate. The fluxes were divided into high, middle, and low classes. 18 refs., 46 figs., 12 tabs.

9459 (DOE/EV/01199—65, pp 159-168) **Interlaboratory comparisons of reference precipitation samples.** Peden, M.E.; Lockard, J.M. Jul 1987. NTIS, PC A15/MF A01. Order Number DE87012648/JAW.

In Study of atmospheric pollution scavenging: Twenty-first progress report.

The analytical chemistry laboratory continued its participation in the interlaboratory comparisons of precipitation chemical analyses sponsored by the World Meteorological Organization (WMO). In the past three years our involvement in international precipitation chemistry intercomparisons expanded to include participation in studies conducted by the Canadian Long Range Transport of Atmospheric Pollutants (LRTAP) Program and the European Monitoring and Evaluation Program (EMEP) carried out by the Norwegian Institute for Air Research. These programs provide valuable data on the comparability of chemical determinations made at geographically disperse laboratories as well as documentation of the analytical procedures that are being utilized for precipitation chemistry measurements. This data base is an important source of information when comparing chemical results from different monitoring programs. 3 refs., 4 tabs.

9460 (DOE/EV/01199—65, pp 169-192) **Quality assurance of precipitation chemistry analyses using ion balance calculations.** Lockard, J.M. Jul 1987. NTIS, PC A15/MF A01. Order Number DE87012648/JAW.

In Study of atmospheric pollution scavenging: Twenty-first progress report.

A rigorous internal quality assurance program has been developed to ensure that laboratory measurements are of the highest quality. As a part of this program, each sample analysis is verified by the use of an ion balance calculation. The ion balance data have been used in part to develop objective criteria for the reanalysis of samples on a routine basis. A closer examination of these data has revealed patterns in the ion ratios that are a function of sample pH, site location, and collection season. These patterns are discussed in terms of how to most effectively utilize ion balance data to verify the accuracy of laboratory measurements. The Illinois State Water Survey (ISWS) has been responsible for the chemical analyses of precipitation and dry deposition samples generated from the monitoring network. Over 50,000 wet deposition samples representing 200 sites have already been processed by the ISWS Laboratory. 5 refs., 14 figs., 2 tabs.

9461 (DOE/EV/01199—65, pp 193-202) **A comparison of ion chromatography and automated colorimetry for the determination of major anions in precipitation.** Bachman, S.R. Jul 1987. NTIS, PC A15/MF A01. Order Number DE87012648/JAW.

In Study of atmospheric pollution scavenging: Twenty-first progress report.

The two most common methods utilized and referenced for the determination of the anions Cl, NO_3, and SO_4 in atmospheric

samples are automated colorimetry and ion chromatography (Fung, et al., 1979). These two methods, and their associated instrumentation, were selected for an analytical comparability study because of their widespread use. Limited work by others in this field have demonstrated the comparability of these techniques for precipitation analyses. For this study, 200 randomly selected precipitation samples were chosen from the NADP/NTN network and analyzed by the Illinois State Water Survey laboratory. Samples collected during a late summer, early fall period included varied climatic and geographic regions. Statistical comparisons of data obtained from each of the methods were the major emphases of this study. Detection limits, precision, method bias, and analyte concentration values were compared. 5 refs., 3 figs., 2 tabs.

9462 (DOE/EV/01199—65, pp 203-214) **Long-term ionic stability of precipitation samples.** Peden, M.E.; Skowron, L.M. Jul 1987. NTIS, PC A15/MF A01. Order Number DE87012648/JAW.

In Study of atmospheric pollution scavenging: Twenty-first progress report.

By investigating the long-term stability of the major ion species, inferential deductions may be made about the suitability of these types of samples for varied study purposes. Most ion stability studies have focused on short-term chemical changes that occur in precipitation samples. The time scale involved in these studies has varied from hours to six weeks after collection. The long-term stability of ions in solutions is an area of interest that is important if archived samples are ever used for purposes other than their original intent. An example of this instance would include the measurement of trace metals in archived wet deposition samples that were originally collected only for major ion determinations. 2 refs., 9 figs., 3 tabs.

9463 (DOE/EV/01199—65, pp 215-230) **Synthetic rainwater reference samples.** Skowron, L.M.; Peden, M.E. Jul 1987. NTIS, PC A15/MF A01. Order Number DE87012648/JAW.

In Study of atmospheric pollution scavenging: Twenty-first progress report.

Our goal was to formulate and prepare a reference material that could be used as a quality control check sample. The material should be NBS traceable bias and precision, be available at low cost, have ionic concentrations approximating natural rainwater, and possess long-term stability. NBS traceability was accomplished by comparing our results with the certified NBS values. Multiple measurements performed over a five month period were used to assess long-term stability. 3 refs., 10 figs., 6 tabs.

9464 (DOE/EV/01199—65, pp 231-250) **Preliminary data for daily ambient aerosol measurements at the Bondville Research Site.** Stensland, G.J. Jul 1987. NTIS, PC A15/MF A01. Order Number DE87012648/JAW.

In Study of atmospheric pollution scavenging: Twenty-first progress report.

This chapter presents additional methodological and ambient data results. The ambient data results are preliminary, since additional work is needed to develop the best procedure to correct for blanks and for flow calibration. The Illinois State Water Survey (ISWS) has been involved in a major research program to investigate the precipitation scavenging of trace constituents in the atmosphere. The routine collection and analysis of event precipitation samples was begun in June 1979. A routine ambient air sampling program was included with the precipitation chemistry collection project. The field methods and laboratory procedures for the ambient aerosol sampling were chosen to be consistent with the goals and procedures for the precipitation chemistry sampling. The unique features of the Bondville daily aerosol data set are that it is a rather long daily record (starting in May 1977); it includes data for Ca^{2+}, Mg^{2+}, Na^{+}, and K^{+} which are often neglected in other studies; and the method includes an extraction step designed to simulate dissolution of particles in raindrops (i.e., a "soluble" extraction rather than a total extraction).

9465 (DOE/EV/01199—65, pp 251-259) **Ratios of ion concentrations in precipitation to aerosols at the Bondville Site.** Stensland, G.J.; Bowersox, V.C. Jul 1987. NTIS, PC A15/MF A01. Order Number DE87012648/JAW.

In Study of atmospheric pollution scavenging: Twenty-first progress report.

In this chapter we present aerosol and precipitation chemistry data for SO_4^{2-}, Ca^{2+}, Mg^{2+}, K^{+}, and Na^{+}. These data are summarized by season from measurements made at the Bondville Field Site. Of the five species, only SO_4 has both particle and gaseous species to consider. Only recently has SO_2, the primary gaseous sulfur component, been measured at the site (as part of a dry deposition project), so for this chapter no SO_2 data are presented. 5 tabs.

9466 (DOE/EV/01199—65, pp 261-277) **A computer program for calculating state averages from point values.** Su, J.; Stensland, G.J. Jul 1987. NTIS, PC A15/MF A01. Order Number DE87012648/JAW.

In Study of atmospheric pollution scavenging: Twenty-first progress report.

We have developed a computer program to calculate a single representative statistic for each state, given a variable that is measured at a limited number of sites across the United States. Our program is called AREA for ARea Estimating Algorithm. 7 refs., 5 figs., 4 tabs.

9467 (DOE/EV/01199—65, pp 279-308) **The description and comparison of a prototype trajectory model with the ARL-ATAD [Air Resources Laboratories Atmospheric Transport and Dispersion] Model.** Doty, K.G. Jul 1987. NTIS, PC A15/MF A01. Order Number DE87012648/JAW.

In Study of atmospheric pollution scavenging: Twenty-first progress report.

Concerns surrounding air and precipitation quality have led to frequent use of trajectory models in the past decade in an attempt to relate natural and anthropogenic sources of various constituents to those observed in the media in question. These trajectory models range in complexity from efforts such as using the output of a prognostic, mesoscale, numerical weather prediction model, to those using observed rawinsonde data in a relatively simple diagnostic model. An example of the latter is the Air Resources Laboratories Atmospheric Transport and Dispersion (ARL-ATAD) Model of Heffter (1980) (hereafter referred to as the ATAD model). The ATAD model was designed to calculate large numbers of boundary layer trajectories from several origins in an economical manner. The goal of the analyses and the type of data led to the development of a new trajectory model (hereafter referred to as the ISWS model). This chapter includes an overview of some recent work with the ATAD model; a description of the ATAD model; sources of error in trajectory calculations; a description of the ISWS model; comparison of the ATAD and ISWS models; and conclusions. 28 refs., 13 figs., 1 tab.

9468 (DOE/EV/01199—65, pp 309-327) **Screening criteria for NADP [National Atmospheric Deposition Program] dry bucket data.** Gatz, D.F.; Bowersox, V.C.; Su, J. Jul 1987. NTIS, PC A15/MF A01. Order Number DE87012648/JAW.

In Study of atmospheric pollution scavenging: Twenty-first progress report.

Dry bucket samples were collected at all National Atmospheric Deposition Program (NADP) sites from the network's inception in mid-1978 until June 1984, when the collection of the dry samples became optional. A one-month intercomparison of dry deposition monitoring and measurement methods at an Illinois grassland site included a detailed comparison of results for sulfur dry deposition to buckets and other surrogate surfaces, as well as fluxes measured by micrometeorological techniques (Dolske and Gatz, 1984). Sulfur dry deposition fluxes measured by the bucket collectors were consistently the highest of those measured by the various surrogate surfaces. This work analyzes a portion of the existing dry bucket data set to determine the effect of various screening criteria on the frequency distribution of measured dry fluxes of each measured ion. 15 refs., 8 figs., 2 tabs.

9469 (DOE/EV/01199—65, pp 329-340) **An annotated description of the atmospheric chemistry sampling station at Bondville, Illinois.** Dossett, S.R. Jul 1987. NTIS, PC A15/MF A01. Order Number DE87012648/JAW.

In Study of atmospheric pollution scavenging: Twenty-first progress report.

This paper briefly details the physical and climatological characteristics and the history of site development. The Illinois State Water Survey (ISWS) Atmospheric Chemistry Section has carried out studies involving the chemical and physical components of wet and dry deposition and aerosol materials at the field site since February 1978. These studies have included elaborate collection and analysis procedures and substantial research in the areas of sampling development and monitoring. The changing requirements of resource decision makers require information that can only be gained at sites which contain historical records regarding all of these activities. 6 refs., 2 figs.

9470 **(EPRI-EA—5333) Effect of power plant NO/sub x/ emissions on ozone levels: Final report.** Seigneur, C. (Systems Applications, Inc., San Rafael, CA (USA); Electric Power Research Inst., Palo Alto, CA (USA)). Oct 1987. 378p. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88920065/JAW.

The effect of nitrogen oxides (NO/sub x/) emissions from large power plants on O_3 formation in the atmosphere was investigated by means of computer simulations of the atmospheric chemistry, transport, and diffusion processes involved in O_3 formation. Three different environments were considered: (1) the St. Louis urban area, (2) the Los Angeles basin, and (3) a rural environment comprising three hypothetical scenarios typical of the southwestern, southeastern, and midwestern US. One-day air quality simulations were conducted for St. Louis. Reducing the emissions of the two major power plants (50% of the total NO/sub x/ emissions) by 90% had a negligible effect on O_3 air quality for the conditions considered. Two-day simulations were conducted for the Los Angeles basin. Scenarios involving various changes in hydrocarbons (ROG) and NO/sub x/ emissions suggest that ROG emission reductions yield a notable decrease in peak O_3 concentrations, whereas NO/sub x/ emission reductions yield an increase in peak O_3 concentrations. The rural environment simulations showed that reducing NO/sub x/ emissions by 90% can reduce O_3 formation in power plant plumes. However, the incremental O_3 levels never exceed 35 ppB. 117 refs., 80 figs., 30 tabs.

9471 **(Juel—2095) Meteorological tower of the Juelich Nuclear Research Centre.** Polster, G.; Geiss, H.; Heinemann, K. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Abt. Sicherheit und Strahlenschutz). Nov 1986. 35p. (In German). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88751524/JAW.

The measurements at the meteorological tower provide the data for propagation calculations, which are necessary for the assessment, co-ordination and limitation of the inevitable emission during operation of reactors and laboratories. Actual meteorological values are used for propagation calculations and emission analyses. The tower also supplies the meteorological data for the research project on the spread of harmful substances in the atmosphere and environmental loading. At the same time, it is the place of emission with variable height of emission for propagation experiments. Apart from the description of the tower, measurement and climatic values are given in tables.

9472 (KFK-PEF—12-Vol.1, pp 25-31) **Water-, needle- and soil-related analyses accompanying research done with open-top chambers and an air measuring survey conducted at Edelmannshof/Welzheimer Wald.** Evers, F.H. (Forstliche Versuchs- und Forschungsanstalt Baden-Wuerttemberg, Freiburg im Breisgau, Germany, F.R.). Apr 1987. (In German). NTIS (US Sales Only), PC A15/MF A01. Order Number DE88750533/JAW. (CONF-8703151—Vol.1).

From 3. PEF status colloquium of Kernforschungszentrum Karlsruhe G.m.b.H.; Karlsruhe, F.R. Germany (10 Mar 1987).

Above all, manganese, sulphate and nitrate were found to be considerably less concentrated in throughfall collected in chambers of filtered air as compared with that in chambers of surrounding air, or even with open-air spruce stands. Also, calcium and magnesium were found to be less concentrated in filtered air.

9473 **(KFK-PEF—18) Economic and political consequences of the forest die-back - analysis of efficiency and instruments for a political response.** Niesslein, E.; Loosen, H.J.; Wilkening, W.; Guenther, K.; Tampe-Oloff, M.; Saile, P. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Projekt Europaeisches Forschungszentrum fuer Massnahmen zur Luftre). Dec 1986. 430p. (In German). NTIS (US Sales Only), PC A19/MF A01. Order Number DE88750534/JAW.

In this final report the following main points are discussed: considerations and calculations with regard to quantitative and timber market relevant consequences of the forest disease; timber market political preventions to avoid unfavourable consequences of a possible situation of overflow; the economic and property political limits of the forest disease for private forest owners; expected landscape ecological consequences and probabilities of its evaluation; conclusions from recognizable trends in the international environment policy; connecting and further leading considerations in political sciences. With 76 figs., 289 refs..

9474 **(NP—8750521) Ozone measurements near the ground and in the atmosphere in the second half-year 1986.** (Deutscher Wetterdienst, Hohenspeissenberg (Germany, F.R.). Meteorologisches Observatorium). 1987. 180p. (In German). NTIS (US Sales Only), PC A09/MF A01. Order Number DE88750521/JAW.

Diagrams and tables, also for SO/sub 2/ in surface air.

9475 **(PB—88-102983/XAB) Model for predicting the influence of moisture stress on crop losses caused by ozone.** King, D.A. (Portland Univ., OR (USA). Dept. of Physical and Life Sciences). 1987. 18p. NTIS, PC A03/MF A01.

Pub. in Ecological Modelling, Vol. 35, 29-44(Feb 1987).

Estimates of crop losses caused by ambient ozone are usually based on results from fumigation experiments performed on adequately watered crops. However, drought frequently affects crop growth, and moisture stress has been found to retard the appearance of ozone injury. To evaluate the effect of drought, a model was constructed that computes the influence of moistures stress on yield losses caused by ozone. The model was calibrated and run for soybean (Glycine max (L.) Merr.) using soil characteristics, weather, and ozone inputs from the Corn Belt states (Illinois, Indiana, Iowa, Missouri, and Ohio).

9476 **(PNL—6173) Estimation of aerial deposition and foliar uptake of xenobiotics: Assessment of current models.** Link, S.O.; Fellows, R.J.; Cataldo, D.A.; Droppo, J.G.; Van Voris, P. (Pacific Northwest Lab., Richland, WA (USA)). Oct 1987. Contract AC06-76RL01830. 92p. NTIS, PC A05/MF A01; GPO Dep. Order Number DE88000993/JAW.

This report reviews existing mathematical and/or computer simulation models that estimate xenobiotic deposition to and transport through (both curricular and stomatal) vegetative surfaces. The report evaluates the potential for coupling the best of those models to the existing Uptake, Translocation, Accumulation, and Biodegradation model to be used for future xenobiotic exposure assessments. Here xenobiotic compounds are defined as airborne contaminants, both organic and gaseous pollutants, that are introduced into the environment by man. Specifically this document provides a detailed review of the state-of-the-art models that addressed aerial deposition of particles and gases to foliage; foliar and cuticular transport, metabolism, and uptake of organic xenobiotics; and stomatal transport of gaseous and volatile organic xenobiotic pollutants. Where detailed information was available, parameters for each model are provided on a chemical by chemical as well as species by species basis. Sufficient detail is provided on each model to assess the potential for adapting or coupling the model to the existing UTAB plant exposure model. 126 refs., 6 figs., 10 tabs.

9477 **Long-term cluster growth modeling.** Kyle, T.G. (International Technology Division, Los Alamos National Laboratory, Los Alamos, New Mexico). *Journal of Geophysical Research;* 92: No. D10, 12007-12012(20 Oct 1987).

The growth of particle clusters is modeled by allowing the particles to be moved by the atmospheric winds and a random ve-

locity component. The dispersion of the cluster is followed for 432 hours. The results from many model runs using wind fields during a 2-year period indicate that clusters grow with a time-varying exponent. The growth between 40 and 150 hours is exponential in time. The rapid growth can be explained as resulting from horizontal wind shear. copyright American Geophysical Union 1987

9478 **CO_2 exchange characteristics of Pinus taeda L. shoots exposed to variable ozone levels and precipitation chemistries.** Hanson, P.J.; McLaughlin, S.B. (Oak Ridge National Lab., TN). *Plant Physiology, Supplement;* **83**: No. 4, 81(Apr 1987). (CONF-8707108—). Contract AC05-84OR21400.

From Annual meeting of the American Society of Plant Physiologists; St. Louis, MO, USA (19 Jul 1987).

Carbon dioxide exchange rates (CER) were measured as a function of photosynthetic photon flux densities (PPFDs) on seedlings of two loblolly pine (Pinus taeda L.) families following 6- or 12-week exposures to variable levels of ozone (filtered or ambient air + 160 nl L^{-1}) and acid precipitation (pH 3.5, 4.3, and 5.0). Exposures were made in open-top field chambers. CERs of whole shoots were measured in an open infrared gas analysis system at 6 levels of PPFD (0, 33, 60, 410, 800, and 1660 μmol m^{-2} s^{-1}). Compared with control plants, ozone-treated seedlings exhibited statistically significant reduction in light-saturated CER of 36 and 28% for plants measured at 6- and 12-weeks, respectively. At 12 weeks, pH 3.5 and 4.3 precipitation treatments enhanced light-saturated CER by an average of 37% over that observed for seedlings exposed to the pH 5.0 treatment. No differences in dark respiration (CER at 0 PPFD) were detected between treatments. Enhancements of CER resulting from acid precipitation treatments were of the same magnitude as CER reductions due to ozone exposures.

9479 **An intercomparison of instruments for measuring the concentration of sub-0.1 μm aerosols.** Knutson, E.O.; Sinclair, D.; Wutu, K.; Hinchliffe, L.; Franklin, H. (Environmental Measurements Lab., U.S. Dept. of Energy). pp 60-63 of Proceedings of the 30th annual technical meeting on environmental integration technology today for a quality tomorrow. Mt. Prospect, IL; Institute of Environmental Sciences (1984). (CONF-8405403—).

From 30. annual technical meeting on environmental integration technology today for a quality tomorrow; Orlando, FL, USA (1 May 1984).

A week-long intercomparison was carried out to determine the agreement between the Pollak condensation nucleus counter (CNC), the active scattering aerosol spectrometer (ASAS-X), and the Liu-Pui method of generating calibration aerosols. The ratio of the Pollak:Liu-Pui was found to be 0.63:1, and was virtually independent of concentration and the aerosol material used. Similarly, the ratio of the Pollak readings to the ASAX-X was 0.72:1. Other recent comparisons show similarly large differences.

5003 Radioactive Materials Monitoring And Transport

REFER ALSO TO CITATION(S) 8596, 8626, 9283, 9471

9480 (INIS-mf—11048, pp 182) **Studies of the seasonal fluctuations of radon 222 in the air of tunnel mines.** Vyrbanov, P. (Meditsinska Akademiya, Sofia, Bulgaria. Nauchen Inst. po Rentgenologiya i Radiobiologiya). Oct 1985. (In Bulgarian). NTIS (US Sales Only), PC A09/MF A01. Order Number DE88780035/JAW. (CONF-8510479—).

From 6. national congress of roentgenology, radiology and radiobiology; Sofia, Bulgaria (4 Oct 1985).

9481 **(SCPRI-RM—5-1987) Monthly results of measurements, May 1987.** (Service Central de Protection contre les Rayonnements Ionisants, 78 - Le Vesinet (France)). Jun 1987. 52p. (In French). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88751639/JAW.

This report of the SCPRI exposes an interpretation of the principal results concerning the routine monitoring of environmental radioactivity in France: atmospheric dusts, rainwater, surface waters, underground water, drinking water, sewage water, food chain (milk, vegetables, fishes), sea water around nuclear plant sites and other sites, sediments. The activities of various radioisotopes are presented in tables. This report exposes also the results of special radiation measurements resulting from the Chernobyl accident.

9482 **(SCPRI-RM—6-1987) Monthly results of measurements, June 1987, with supplement related to 1987 second quarter.** (Service Central de Protection contre les Rayonnements Ionisants, 78 - Le Vesinet (France)). Jul 1987. 71p. (In French). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88751640/JAW.

This report of the SCPRI exposes an interpretation of the principal results concerning the routine monitoring of environmental radioactivity in France: atmospheric dusts, rainwater, surface waters, underground water, drinking water, sewage water, food chain (milk, vegetables, fishes), sea water around nuclear plant sites and other sites, sediments. The activities of various radioisotopes are presented in tables. This report exposes also the results of special radiation measurements resulting from the Chernobyl accident.

5006 Regulations

REFER ALSO TO CITATION(S) 8769, 8770, 9463

51 ENVIRONMENTAL SCIENCES, TERRESTRIAL

5101 Basic Studies

REFER ALSO TO CITATION(S) 9449

9483 (KFK-PEF—12-Vol.1, pp 251-256) **Structure and function of mycorrhizae in forest ecosystems.** Kottke, I.; Haug, I.; Oberwinkler, F. (Tuebingen Univ., Germany, F.R. Lehrstuhl Spezielle Botanik). Apr 1987. (In German). NTIS (US Sales Only), PC A15/MF A01. Order Number DE88750533/JAW. (CONF-8703151—Vol.1).

From 3. PEF status colloquium of Kernforschungszentrum Karlsruhe G.m.b.H.; Karlsruhe, F.R. Germany (10 Mar 1987).

The ontogeny of mycorrhizas is investigated by inoculating Picea abies under sterile cultural conditions, allowing permanent observation. Structural changes and enzyme acitivites in the Hartig net region caused by different levels and forms of nitrogen will be studied by means of TEM. The influence of hyphal mantle structure on nutrient uptake will also be studied.

9484 **(ORNL/TM—10575) FORECE: A forest succession model for southern Central Europe.** Kienast, F. (Oak Ridge National Lab., TN (USA)). Oct 1987. Contract AC05-84OR21400. 78p. NTIS, PC E05/MF A01; 1; GPO Dep. Order Number DE88003736/JAW.

A general forest succession model that simulates forest stand development for the most common site conditions in the southern part of Central Europe (with emphasis on Switzerland) is described. The model provides a useful tool for testing hypotheses about forest succession and enables the user to evaluate the impacts of natural and human disturbances on forest communities. Written in FORTRAN, it is a JABOWA-type simulator (Botkin et al., 1972) and is based on existing succession models for forests in eastern and western North America. Birth, growth, and death of 31 species of individual trees are simulated on a multitude of 1/12-ha plots. The successional characteristics of each replicate are subsequently averaged to obtain the forest development on a landscape level. Existing light in the forest stand, climatic conditions, soil properties, and other environmental factors control the growth of each individual tree. Species-specific input data such as light requirements and drought resistance were obtained from silvics information and phytosociological descriptions. Compared with previous simulators, some major modifications were made, including the incorporation of the indicator value concept of Ellenberg (1978). This approach is partially optional and is used to describe the ecophysiological behavior of the 31 different tree species incorporated in the model.

5102 Chemicals Monitoring And Transport

REFER ALSO TO CITATION(S) 8557, 8603, 8621, 9514

9485 **(CONF-871075—21) How clean is clean: A review of Superfund cleanups.** Bacs, C.F. III; Marland, G. (Oak Ridge National Lab., TN (USA)). 1987. Contract AC05-84OR21400. 7p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88001744/JAW.

From 3. Oak Ridge model conference on waste problems; Oak Ridge, TN, USA (13 Oct 1987).

The Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA or "Superfund") and its reauthorization, the Superfund Amendments and Reauthorization Act of 1986 (SARA), have instituted a national program to clean up sites contaminated by hazardous chemical wastes. During the first six years under CERCLA, 14 sites on the National Priorities List (NPL) have been cleaned up, and remedial actions have been initiated at 143 NPL sites. Under SARA, efforts are underway to clean up the 888 sites currently on the NPL and to identify the potential 60,000 remaining abandoned hazardous waste dump sites in the US. The issue is: How clean is clean? That is, when is remedial action completed and what levels of cleanup must be achieved for a site to be released for unrestricted use? The SARA statute provides a framework for how cleanups are to be performed and specifies levels of cleanup that Congress and the President said must be achieved. This paper presents a brief overview and interpretation of the cleanup process as laid out under SARA and discusses the results of our analysis of RODs. 5 refs.

9486 (KFK-PEF—12-Vol.1, pp 45-59) **Study for and demonstration of a modular inventory and monitoring system for actual damages in European forests.** Hildebrandt, G.; Grundmann, O.; Schmidtke, H.; Tepasse, P. (Freiburg Univ., Germany, F.R. Abt. fuer Luftbildmessung und -interpretation). Apr 1987. (In German). NTIS (US Sales Only), PC A15/MF A01. Order Number DE88750533/JAW. (CONF-8703151—Vol.1).

From 3. PEF status colloquium of Kernforschungszentrum Karlsruhe G.m.b.H.; Karlsruhe, F.R. Germany (10 Mar 1987).

The main object of the research was to develop an inventory and monitoring system which could be used as a model in all member states of the European Community and other European countries. The proposed system should be demonstrated by a practical inventory of a large forest area. The system should be based on remote sensing using colour-infrared (CIR) aerial photography and additional field observations. Forest decline inventory on large areas using CIR-photos has proved as a system with many advantages against pure terrestrial inventories. The use of a well-defined catalogue of basic parameters and the application of a uniform classification method ensures the comparability of inventories in different countries at different times. The modular structure allows to adapt the inventory system to different requirements and conditions.

9487 (KFK-PEF—12-Vol.1, pp 61-69) **Development of a geographic information system for investigation and monitoring of forest disease.** Baehr, H.P.; Behr, F.J.; Gossmann, H.; Saurer, H. (Karlsruhe Univ., T.H., Germany, F.R. Inst. fuer Photogrammetrie und Fernerkundung; Freiburg Univ., Germany, F.R. Inst. fuer Physische Geographie). Apr 1987. (In German). NTIS (US Sales Only), PC A15/MF A01. Order Number DE88750533/JAW. (CONF-8703151—Vol.1).

From 3. PEF status colloquium of Kernforschungszentrum Karlsruhe G.m.b.H.; Karlsruhe, F.R. Germany (10 Mar 1987).

This paper describes preliminary investigations into creating a multilayer dataset for a geographic information system. Some accuracy results of multitemporal evaluation of Landsat TM data are presented. Results of rectification of scanner data based on collinearity equations are discussed as precondition for integration in a geographic information system. The state of data capture and development of the geographical information system is reported.

9488 (KFK-PEF—12-Vol.1, pp 71-80) **Forest damage inventories for local areas.** Wolf, C. (Freiburg Univ., Germany, F.R. Abt. fuer Forstliche Biometrie). Apr 1987. (In German). NTIS (US Sales Only), PC A15/MF A01. Order Number DE88750533/JAW. (CONF-8703151—Vol.1).

From 3. PEF status colloquium of Kernforschungszentrum Karlsruhe G.m.b.H.; Karlsruhe, F.R. Germany (10 Mar 1987).

The Terrestrial Forest Damage Inventory (TWI) provides regional forest damage information. The purpose of this project is to prepare specifications for the design of area inventories, so that forest managers can determine the extent of forest damage for their particular areas. Two forest areas of 502 ha and 33 ha were chosen for test surveys. Sampling methods will be tested with the goals being to ensure consistency and compatability with the TWI, reduce the influence of subjective judgements by survey teams, and optimize the density and size of sampling plots.

9489 (KFK-PEF—12-Vol.1, pp 81-86) **Inventory methods for tree damage inventories in relation to spatial distribution.** Koehl, M. (Freiburg Univ., Germany, F.R. Abt. fuer Forstliche Biometrie). Apr 1987. (In German). NTIS (US Sales Only), PC A15/MF A01. Order Number DE88750533/JAW. (CONF-8703151—Vol.1).

From 3. PEF status colloquium of Kernforschungszentrum Karlsruhe G.m.b.H.; Karlsruhe, F.R. Germany (10 Mar 1987).

The purpose of this evaluation is to find permanent inventory methods for district tree damage inventories. The first step was to examine the effect of sample fraction, sampling method (tree distance methods, fixed radius plots) and size of the sampling unit with computer generated stands. The tree damage classes were distributed in two ways: Randomly and clustered. The first studies with computer generated stands showed no difference between number of and size of plots and between the fixed radius plots and the tree distance methods. One sample unit per hectar was sufficient to estimate the tree damage. These results need to be verified using data from natural stands.

9490 (KFK-PEF—12-Vol.1, pp 221-230) **Element-flow in forest ecosystems - invertebrate animals as accumulative indicators.** Roth-Holzapfel, M; Funke, W. (Ulm Univ., Germany, F.R. Abt. Oekologie und Morphologie der Tiere). Apr 1987. (In German). NTIS (US Sales Only), PC A15/MF A01. Order Number DE88750533/JAW. (CONF-8703151—Vol.1).

From 3. PEF status colloquium of Kernforschungszentrum Karlsruhe G.m.b.H.; Karlsruhe, F.R. Germany (10 Mar 1987).

In a spruce stand nearby Ulm element contents of plant material (needles, litter, fine and finest roots) and of arthropods (of different trophic levels) have been determined. The estimation of the 'element-flows' in ecosystem - with special regard to invertebrates - and also the suitability of arthropods as indicators of inorganic pollution have been of special interest. The retention of elements in plant materials and invertebrates per ha - exemplified for the year 1985 - has been evaluated as basic data for the element-flows. Arthropods accumulate elements from their food - partly - to a great extent. Especially, this in significant for Curculionidae with rhizophagous larvae at (Cr, Hg, Sb, Se and Ag) for needle-eaters and sap-suckers at (Fe, Zn and Cu) and for detritophagous species or groups (Zn, Cu, Mo and Cd). In Scolytids from 19 forest-districts in Baden-Wuerttemberg the concentration of Mn, Zn, Fe, Al, Ba, Cu and Cd have been determined. The content of Zn and especially of Cu in Ips typographus and Trypodendron lineatum is similar in all investigated districts. Great differences have been observed in the contents of Fe, Ba, Al and Cd. To evaluate the influence of inorganic immissions on the element content of Scolytidae, data of the element-composition of soil and subsoil are of special interest.

9491 (KFK-PEF—12-Vol.1, pp 231-239) **Changes in the state of humus as related to forest decline under consideration of fertilizing experiments.** Babel, U.; Belotti, E. (Hohenheim Univ., Stuttgart, Germany, F.R. Inst. fuer Bodenkunde und Standortslehre). Apr 1987. (In German). NTIS (US Sales Only), PC A15/MF A01. Order Number DE88750533/JAW. (CONF-8703151—Vol.1).

From 3. PEF status colloquium of Kernforschungszentrum Karlsruhe G.m.b.H.; Karlsruhe, F.R. Germany (10 Mar 1987).

In 37 forest plots in the Federal Republic of Germany the humus profiles were morphologically investigated in the field; initially between 1960 and 1974, then again between 1984 and 1986. In 11 plots a retardation of litter decomposition processes was found, in 6 plots an acceleration of same. This corresponds to the non-uniform results in the literature in regard to the impact of immissions on soil organisms and humus profiles. Only in one group of plots (spruce in Baar-Schwarzwald) many more instances of retardation (6) than of acceleration were found. - On fertilized plots the expected acceleration was observed.

9492 (KFK-PEF—12-Vol.1, pp 241-250) **Investigations of the vitality of mycorrhizae of limed and non-limed stands.** Ritter, T.; Kottke, I.; Oberwinkler, F. (Tuebingen Univ., Germany, F.R. Lehrstuhl Spezielle Botanik). Apr 1987. (In German). NTIS (US Sales Only), PC A15/MF A01. Order Number DE88750533/JAW. (CONF-8703151—Vol.1).

From 3. PEF status colloquium of Kernforschungszentrum Karlsruhe G.m.b.H.; Karlsruhe, F.R. Germany (10 Mar 1987).

Mycorrhizal vitality of damaged and non-damaged fir and spruce trees is investigated on two testing grounds in the Northern Black Forest. Vitality of fine roots is determined by using the method of FDA vital staining. Ectomycorrhizae of different states of vitality are described and presented in a scheme. As a result of liming, the testing grounds differ in their parameters of the soil. Distinct differences of mycorrhizal vitality can be shown when trees from limed and non-limed stands are compared. Trees from the non-limed stands show a higher amount of dying and dead fine roots. No such differences can be found between damaged and non-damaged trees when they grow on the same stand. In all cases of damaged trees the amount of vital mycorrhizae was surprisingly high. Generally a higher amount of starch grains occurred in the central cylinder of fine roots of the damaged trees.

9493 (KFK-PEF—12-Vol.1, pp 269-281) **Project ARINUS. Pt. 1. Purpose and background.** Zoettl, H.W.; Feger, K.H.; Brahmer, G. (Freiburg Univ., Germany, F.R. Inst. fuer Bodenkunde und Waldernaehrungslehre). Apr 1987. (In German). NTIS (US Sales Only), PC A15/MF A01. Order Number DE88750533/JAW. (CONF-8703151—Vol.1).

From 3. PEF status colloquium of Kernforschungszentrum Karlsruhe G.m.b.H.; Karlsruhe, F.R. Germany (10 Mar 1987).

In the research project ARINUS the effects of restabilization measures and atmospheric deposition on N- and S-cycling of the eco- and hydrosphere of Black Forest sites are studied. The aim is to quantify the natural and anthropogenic components. This provides a better estimation of the effects of additional inputs by deposition or fertilizers. The mobility of the anions NO/sub 3//sup -/ and SO/sub 4//sup 2-/ highly determines an additional acidification of soil and water. The extent of nitrification in acid forest soils and N-uptake by vegetation is decisive for the acidifying effect of NH/sub 4//sup +/. Besides acidification an increased N-export can also lead to inadmissible nitrate concentrations in drinking water. The investigation combines flux measurements in ecosystems with watershed balances. Pre-examinations resulted in the selection of three comparable subcatchments near Villingen and Schluchsee, respectively. At Villingen also groundwater can be studied in accessible wells. First analyses of ground- and surface water demonstrate a distinct alteration of precipitation during its passage through the bio-, pedo- and lithosphere. The low NO/sub 3//sup -/- and SO/sub 4//sup 2-/-concentrations in the groundwater refer to a high retention. Needle analyses to characterize the nutritional status of the spruce stands revealed poor potassium supply at Villingen. In contrast to that, at Schluchsee, where gold-yellow-chlorosis of older needles is widespread, Mg-deficiency occurs. Thus, the fertilization measures planned in the 2. year of investigation are outlined. Since there is no evidence for an over-saturation with nitrogen, both sites are also suitable for the planned N-fertilization.

9494 (KFK-PEF—12-Vol.1, pp 283-292) **Population dynamics of Physokermes hemicryphus in variously diseased spruce stands.** Ludwig, W.; Smietana, P.; Liebig, G. (Hohenheim Univ., Stuttgart, Germany, F.R. Landesanstalt fuer Bienenkunde). Apr 1987. (In German). NTIS (US Sales Only), PC A15/MF A01. Order Number DE88750533/JAW. (CONF-8703151—Vol.1).

From 3. PEF status colloquium of Kernforschungszentrum Karlsruhe G.m.b.H.; Karlsruhe, F.R. Germany (10 Mar 1987).

The coccid Physokermes hemicryphus is one of the most important honeydew producers on the spruce. 1984-1986 at 4 places in Baden-Wuerttemberg investigations have been made on its population dynamics and on the supply of nutrients of the host tree. The observed spruce plantations were variously diseased; therefore it was checked whether the disease of spruces had an influence on the population dynamics of Ph. hemicryphus. During the time of investigations the population density decreased at all places. It was found, that the population density was always higher at two places than at the others. These differences between the places could not be explained with the loose of needles, with the supply of nutrients and with other characteristics of the places (altitude, geological formation). When the statistical analyses were made with the individual dates of every tree, there were some correlations between the loose of needles on the one side and the supply and the weight of needles on the other side and between the population density and the characteristics of the trees. The results of the different places did not agree.

9495 (KFK-PEF—12-Vol.1, pp 293-303) **Succession of ground-vegetation indicating possible ecological consequences of the forest-dieback.** Buerger, R. (Freiburg Univ., Germany, F.R. Inst. fuer Landespflege). Apr 1987. (In German). NTIS (US Sales Only), PC A15/MF A01. Order Number DE88750533/JAW. (CONF-8703151—Vol.1).

From 3. PEF status colloquium of Kernforschungszentrum Karlsruhe G.m.b.H.; Karlsruhe, F.R. Germany (10 Mar 1987).

The aim of the project is to evaluate the possible ecological consequences of the 'forest-dieback' in the Black Forest. This will be achieved by documenting the transition of ground vegetation. Succession in poor forest types (Luzulo-Fagetum, Luzulo-Abietetum) is studied by comparing species-composition and ecological indication - value of present plant community investigations with those of the past. An increase of presence of light- and nitrogen-demanding species can be proved but has to be statistically secured. The changement of species-composition results in an increase of light- and nitrogen-indication value.

9496 (KFK-PEF—12-Vol.1, pp 305-314) **Reaction of vegetation to fertilisation on forest-stands.** Schornick, O.K. (Freiburg Univ., Germany, F.R. Inst. fuer Landespflege). Apr 1987. (In German). NTIS (US Sales Only), PC A15/MF A01. Order Number DE88750533/JAW. (CONF-8703151—Vol.1).

From 3. PEF status colloquium of Kernforschungszentrum Karlsruhe G.m.b.H.; Karlsruhe, F.R. Germany (10 Mar 1987).

On experimental fertilisation areas of the 'Forstliche Versuchs- und Forschungsanstalt Baden-Wuerttemberg' a comparison of unfertilized and fertilized fields concerning vegetation shows: Typical for the unfertilized fields is the small quantity of species within herb layer. The fertilized fields are distinguished into a vegetation-unit similar to the unfertilized fields and a vegetation-unit with high quantity of species. The latter vegetation type includes plant species with high requirements to the supply of nitrogen and light besides species with little requirements to the supply of these ecological factors. As a result there is a coexistence of groups of species with different ecological behaviour. Besides the combination of the species fertilization affects the cover-abundance, sociability and the height of the layers. Since the evaluation on these subjects are not done yet, a final interpretation of the fertilization-effects cannot be presented.

9497 (KFK-PEF—12-Vol.1, pp 315-322) **Progeny test of Norway spruce stands in the Black Forest (areas of origin 840 08 and 840 09) aiming at 1. Improvement of immission tolerance; 2. Conservation of genetic resources of damaged stands in high altitudes ('genetic bank').** Geldbach, J.; Schroeder, S.; Widmaier, T. (Forstliche Versuchs- und Forschungsanstalt Baden-Wuerttemberg, Freiburg im Breisgau, Germany, F.R. Abt. Botanik und Standortskunde). Apr 1987. (In German). NTIS (US Sales Only), PC A15/MF A01. Order Number DE88750533/JAW. (CONF-8703151—Vol.1).

From 3. PEF status colloquium of Kernforschungszentrum Karlsruhe G.m.b.H.; Karlsruhe, F.R. Germany (10 Mar 1987).

By selecting sites with Norway spruce in the Black Forest, we started in the summer 1985 a programme for progeny tests. The most important criteria of testing are immission tolerance phenomena. The success of selecting will be tested under field conditions in heavily polluted sites. Moreover, the selected sites are considered as resources for conserving genetic potentials of local importance. We will accompany this programme by analyzing the isozyme patterns of different progenies. This may contribute to improve the knowledge about genetic structures and to detect relations between genetic potentials and immission tolerance.

9498 (KFK-PEF—12-Vol.1, pp 211-220) **Protozoa and Metazoa as sensitive indicators of alterations in the ecosystem 'spruce forest'.** Funke, W.; Bernhard, M.; Herlitzius, H.; Hoefer, H.; Jans, W.; Lehle, E.; Ratajczak, L.; Roth-Holzapfel, M.; Schmitt, G.; Stumpp, J. Apr 1987. (In German). NTIS (US Sales Only), PC A15/MF A01. Order Number DE88750533/JAW. (CONF-8703151—Vol.1).

From 3. PEF status colloquium of Kernforschungszentrum Karlsruhe G.m.b.H.; Karlsruhe, F.R. Germany (10 Mar 1987).

Soil animals in a manifold way are well qualified as indicators of grave alterations in spruce forest-ecosystems. The Protura, a small group of apterygote insects, are of special significance, here, because they predominantly feed on the ectotrophic mycorrhiza of trees. Thus, the population density, esp. of their larvae, relates to the vitality and the rate of development of mycorrhiza. If there is a strong correlation between the vitality of mycorrhiza and the physical condition of trees the abundance of Protura and their share of larval stages may yield valuable informations about the diseases of single trees and/or whole stands at a very early time. Fluctuations of population densities and litter decomposition are determined to a high degree by weather conditions. By this, Diptera, and among them esp. Sciaridae, are of special interest. The unfavorable weather of the years 1980 and 1985 (and generally, within the last decennia) could not be without far-reaching effects on the vitality of trees. Their growth and their power of resistance against plant and animal pests and against toxic pollutions might have been reduced decisively. Lime- and fertilizer-applications provoked in research areas near Ulm and Ochsenhausen extreme alterations of zoocoenoses. Some negative effects of liming seem to be compensated by additional fertilizer-applications. - Most of the investigated animal groups will react very quickly to the different ways of soil-management. This was obviously the case with the Protozoa. Thus, Ciliata reflect alterations of the edaphon already within a few weeks. With the example of Testacea and Ciliata it was demonstrated that experimental pollutions of soil surface by H/sub 2/SO/sub 4/, solutions of NaCl and pesticides partly are still effective even up to 18 months later.

9499 (PNL-SA—13393) **Competitive adsorption of aromatic nitrogen bases on subsurface materials.** Zachara, J.M.; Thomas, B.L. (Pacific Northwest Lab., Richland, WA (USA)). Aug 1987. Contract AC06-76RL01830. 14p. (CONF-851027—14). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88000992/JAW.

From 24. Hanford life sciences symposium and environmental research on complex organic mixtures; Richland, WA, USA (20 Oct 1985).

The inorganic sorbate pairs quinoline-acridine and quinoline-pyridine were contacted at micromolar concentrations with two low-organic subsoils to determine if competitive sorption occurred. Using quinolines as the reference compound, competition was observed between sorbates in the acidic subsoil when the soil-water pH promoted compound ionization. Pyridine and quinoline mutually competed while acridines sorbed independently. Acridine was the least soluble and most strongly adsorbed compound and induced the greatest reduction in quinoline binding. Competitive sorption was minimal in the higher pH subsoil where the compounds are neutral. It is suggested that competition occurred between the protonated species for a subset of reactive charged sites that exhibited high affinity for the organic cations. 17 refs., 7 figs., 3 tabs.

9500 (UCID—21206-43) **In situ detection of organic chemicals.** Angel, S.M.; Daley, P.F.; Kulp, T. (Lawrence Livermore National Lab., CA (USA)). 30 Sep 1987. Contract W-7405-ENG-48. 22p. (DOE/HWP—43). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88001929/JAW.

A portable, remote, chemical-sensing technology based on optically active chemical probes (optrodes), fiber optics, and advanced phase-sensitive optical detection has been demonstrated. The latest generation of fiber-optic instrument and data-acquisition systems can be transported by a single person and is easily modified in the field to perform different sensing tasks. Two optrodes are described here in detail: a reservoir-type probe, which is under development, for analysis of halogenated volatile organic compounds, and a polymer-coated probe for measurement of pH. The extension of these optrode designs to other applications is discussed.

5103 Radioactive Materials Monitoring And Transport

REFER ALSO TO CITATION(S) 8538, 8539, 8545, 8546, 8547, 8548, 8551, 8553, 8554, 8555, 8578, 8580, 8589, 8592, 8594, 8596, 8597, 8598, 8599, 8603, 8604, 8605, 8606, 8607, 8608, 8609, 8610, 8611, 8612, 8613, 8614, 8615, 8616, 8617, 8618, 8619, 8620, 8621, 8623, 8624, 8625, 8626, 8630, 8851, 9481, 9482, 9759, 9760, 9847, 9848

9501 (AERE-G—3445) **Mathematical modelling of fracture hydrology. Final report. January 1983-December 1984.** Herbert, A.W.; Hodgkinson, D.P.; Lever, D.A.; Robinson, P.C.; Rae, J. (UKAEA Atomic Energy Research Establishment, Harwell. Theoretical Physics Div.). Jun 1985. 17p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88750687/JAW.

This report summarises the work performed between January 1983 and December 1984 for the CEC/DOE contract 'Mathematical Modelling of Fracture Hydrology', under the following headings: 1) Statistical fracture network modelling, 2) Continuum models of flow and transport, 3) Simplified models, 4) Analysis of laboratory experiments and 5) Analysis of field experiments.

9502 (AERE-R—10155) **Survey of caesium-137 and plutonium in British soils in 1977.** Cawsw, P.A.; Horrill, A.D. (UKAEA Atomic Energy Research Establishment, Harwell. Environmental and Medical Sciences Div.). Feb 1986. 77p. H.M. Stationery Office, London, price Pound 7.00.

Measurements have been made of the accumulation to 30 cm depth of Cs-137 and plutonium in soils from permanent grassland and woodland in England, Scotland and Wales, and of the concentrations in grass. In Scotland, peat has also been sampled. The sampling points were carefully selected with due regard to their soil type and future permanence, to establish a network of grassland sites at which radionuclide concentrations may be measured over the long-term. The main objective of the survey is to provide information on the integrated deposition of Cs-137, Pu-239+240 and Pu-238 from the atmosphere to provide a baseline in 1977 with which to assess the significance of radioactive accumulations from the routine operation of nuclear facilities. Further objectives are to study the transfer of radionuclides to vegetation, and to compare the concentrations with generalised derived limits for radiological assessment.

9503 (EUR—10788(v.1)) **Study of long-term (10/sup 3/-10/sup 4/Yr) elemental migration in saturated clays and sediments.** Mac Kenzie, A.B.; Scott, R.D.; Ridgway, I.M.; Mc Kinley, I.G.; West, J.M. (Surrc, Glasgow, UK; EIR, Wuerenlingen, Switzerland; GBS, Keyworth, UK). (Commission of the European Communities, Luxembourg). 1986. 44p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88751591/JAW.

This report presents the results of a project to investigate the use of elemental profiles in Scottisch sediments resulting from the Flandrian marine transgression as a natural analogue of radionuclide migration through argillaceous material. The work was carried out within Research Area no. 5 of the CEC project MIRAGE "Natural Geological Migration Systems".

9504 **(EUR—10920) Impact of environmental factors on the migration of Pu, Am, Np and Tc in geological systems.** Prins, M.; Pennders, R.M.J.; Frissel, M.J. (National Institute of Public Health-and Environmental Hygiene, RIVM, Bilthoven, Netherlands). (Commission of the European Communities, Luxembourg). 1986. 118p. NTIS (US Sales Only), PC A06/MF A01. Order Number DE88751600/JAW.

The aim of this study is to provide geochemical data to be included in a model under construction to describe the migration of radionuclides through the geosphere. A large series of distribution coefficients was determined by batch and column experiments. The radionuclides were: Americium-241, Plutonium-238, 239 and 240, Neptunium-237 and Technetium-99. Geological materials were glauconite containing sand and materials from near Gorleben (Federal Republic of Germany). THe main variables of which the impact was studied were: pH, redox potential (Eh), salt concentration and contact time. Also the influence of textural composition, CEC, organic matter content and ionic composition of the associated ground waters on the sorption of the radionuclides was studied. From the data of the batch, column and microcosm studies it can be concluded that the migration of Pu, Am, Np and Tc will be strongly delayed due to adsorption of these nuclides on geological material. In anaerobic systems at low pH values Pu and Am will migrate faster than Np. For aerobic conditions, but also for anaerobic conditions at high pH, Np will migrate faster than Pu and Am. Tc may migrate in aerobic systems; it will become less mobile if reduction occurs. As far as modelling is concerned, without a rather detailed knowledge of the local redox potential and pH, a fair estimate of the migration is not possible.

9505 (IAEA-RL—147, pp 20-27) **Follow-up of grass radioactivity after the Chernobyl accident in the watershed of the river Var.** Grauby, A.; Maubert, H. Jul 1987. NTIS (US Sales Only), PC A05/MF A01. Order Number DE88700361/JAW. (CONF-8609348—).

From Consultants' meeting on the determination of radionuclides in grass ecosystem samples; Vienna, Austria (23 Sep 1986).

This paper reports the results of measurements of Cs-137, Cs-134, Ru-103 and Ru-106 + Rh 106. The study started at the end of May 1986 and lasted up to the end of November 1986. The region where the samples are taken is very mountainous and the grass is used for cattle pasture and forage production. 19 samples were analysed during the season. 2 figs, 3 tabs, map.

9506 (INIS-mf—11048, pp 183) **Strontium-90 and cesium-137 levels evaluation of milk from the region of NPP Kozloduj for the period 1979-1984.** Petkov, T.; Mireva, Z.; Novakova, E.; Kerteva, A. (Meditsinska Akademiya, Sofia, Bulgaria. Nauchen Inst. po Rentgenologiya i Radiobiologiya). Oct 1985. (In Bulgarian). NTIS (US Sales Only), PC A09/MF A01. Order Number DE88780035/JAW. (CONF-8510479—).

From 6. national congress of roentgenology, radiology and radiobiology; Sofia, Bulgaria (4 Oct 1985).

9507 (INIS-mf—11054, pp 38) **Distribution and migration of artificial radionuclides in agriculturally used soils in Styria (Austria).** Meisel, S.; Graller, P.; Kahr, G.; Mueller, H.; Ninaus, W. (Technische Univ., Graz, Austria. Inst. fuer Theoretische Physik und Reaktorphysik; Verein zur Foerderung der Anwendung der Kernenergie, Graz, Austria. Reaktorinstitut). Sep 1987. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88700772/JAW. (CONF-8709196—).

From Annual convention fo the Austrian Physical Society; Vienna, Austria (21 Sep 1987).

9508 **Effect of cooking on radionuclide concentrations in waterfowl tissues.** Halford, D.K. (Department of Energy, Idaho Falls, ID, USA. Idaho Operations Office). *Journal of Environmental Radioactivity (London);* 5: No. 3, 229-233(1987).

Twenty-four commercially raised mallard ducks (Anas platyrhynchos) were released at reactor radioactive leaching ponds in southeastern Idaho and subsequently collected 56 to 188 days later. Liver, gizzard and carcass were analyzed for radionuclide concentrations before and after cooking. Significant decreases ($P < 0.05$) in ^{137}Cs, ^{134}Cs, ^{60}Co and sup(110m)Ag concentrations in carcass and liver samples occurred after cooking. Radionuclide concentrations in gizzard showed no significant change in radionuclide concentrations after cooking. Cesium-134 and ^{137}Cs concentrations decreased by 27% in carcass after cooking and reduced the dose commitment to man by that amount if only the carcass was consumed. No reduction in dose is expected if the carcass and juice were consumed.

5105 Site Resource And Use Studies

REFER ALSO TO CITATION(S) 8580, 8600, 9451

52 ENVIRONMENTAL SCIENCES, AQUATIC

5201 Basic Studies

REFER ALSO TO CITATION(S) 8587, 9449

9509 **(BR—85(7.14)) The ecology of patterned boreal peatlands of northern Minnesota: A community profile.** Glaser, P.H. (Minnesota Univ., Minneapolis (USA). Limnological Research Center). Jun 1987. 110p. U.S. Fish & Wildlife Service, 1010 Gause Blvd., Slidell, LA 70458. Order Number TI88900213/JAW.

This report reviews the ecological information available for patterned boreal peatlands in northern Minnesota. Although vast areas of Canada and Alaska are covered by boreal forests, they extend southward into the continental United States only in northern Minnesota and to a lesser extent in northern Michigan. In northern Minnesota these peatlands comprise large areas of freshwater wetlands whose unique hydrological characteristics promote the development of patterned vegetation. This publication describes the distribution of peatlands, the physical settings in which they exist, and the processes leading to their development on the landscape. Hydrology, water chemistry, and nutrient cycling in bogs and fens are discussed. The plant communities unique to these types of wetlands, their successional trends, and the animal communities inhabiting them are also described. The profile closes with a summary of past human impacts on peatlands and recommendations for future management.

5202 Chemicals Monitoring And Transport

REFER ALSO TO CITATION(S) 8789, 9007, 9196, 9493, 9500

9510 **(CONF-871075—22) Forecasting contaminant concentrations: Spills in the White Oak Creek Basin.** Borders, D.M.; Hyndman, D.W.; Huff, D.D. (Tennessee Univ., Knoxville (USA); Oak Ridge Associated Universities, Inc., TN (USA); Oak Ridge National Lab., TN (USA)). 1987. Contract AC05-84OR21400. 20p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88001743/JAW.

From 3. Oak Ridge model conference on waste problems; Oak Ridge, TN, USA (13 Oct 1987).

The Streamflow Synthesis and Reservoir Regulation (SSARR) model has been installed and sufficiently calibrated for use in managing accidental release of contaminants in surface waters of the White Oak Creek (WOC) watershed at ORNL. The model employs existing watershed conditions, hydrologic parameters representing basin response to precipitation, and a Quantitative Precipitation Forecast (QPF) to predict variable flow conditions throughout the basin. Natural runoff from each of the hydrologically distinct subbasins is simulated and added to specified plant and process water discharges. The resulting flows are then routed through stream reaches and eventually to White Oak Lake (WOL), which is the outlet from the WOC drainage basin. In addition, the SSARR model is being used to simulate change in storage volumes and pool levels in WOL, and most recently, routing characteristics of contaminant spills through WOC and WOL. 10 figs.

9511 (EUR—9962) Ring test programme, 1983-1984: Assessment of biodegradability of chemicals in water by manometric respirometry: Final report. Painter, H.A.; King, E.F. (Water Research Centre, Stevenage (UK)). 1985. 105p. NTIS (US Sales Only), PC A06/MF A01. Order Number DE88900085/JAW.

The aim of this ring rest programme was to extend the experience of the use of the EEC respirometric method from the 12 EEC countries, which participated in the previous ring-test of June 1982, to include as many as possible participants from OECD countries. It broadened the scope of the programme by testing substances that were known to behave abnormally in some way in the original 14-day MITI I method. Fourteen chemicals were divided into 3 groups. Group A were readily biodegradable; reasons for their more consistent behavior than in the MITI I test are discussed. Group C were not readily biodegradable, their erratic behavior being confirmed, while Group B were intermediate in degradability. Aniline, used as the control substance, behaved as expected on over 97% of occasions. The importance of allowing for nitrification in calculating the %ThOD of nitrogen- containing test substance is stressed. It is also concluded that changes in the concentration of ammonia and oxidized nitrogen should be determined, even with test substances not containing nitrogen. A cursory comparison was made between the results obtained in this ring test and with those reported by three laboratories using Repetitive Die-Away (RDA) test.

9512 (GKSS—87/E/15) Environmental problems of the North Sea. Modern measuring methods solving some problems of pollutant input and transport. Weitkamp, C. (GKSS-Forschungszentrum Geesthacht G.m.b.H., Geesthacht-Tesperhude (Germany, F.R.)). 1987. 12p. (In German). Special print from Geogr. Rundsch. (1986) Vol. 38(12) p. 637-645.

The North Sea represents a unique ecological environment, which is threatened by anthropogeneous influences, for many types of animals and plants. Environmental research as the basis for effective measures to protect it is not possible without methodical and measurement development work. This is explained in this article by three examples of the introduction of harmful substances into the North Sea by rivers, by the air and by the combustion of waste containing chlorinated hydrocarbons.

9513 (KFK-PEF—12-Vol.1, pp 257-267) Input and output rates of eight forested catchment areas in the bunter sandstone area of the Black Forest. Einsele, G.; Ehmann, M.; Irouschek, T.; Seeger, T. (Tuebingen Univ., Germany, F.R. Geologisches Inst.). Apr 1987. (In German). NTIS (US Sales Only), PC A15/MF A01. Order Number DE88750533/JAW. (CONF-8703151—Vol.1).

From 3. PEF status colloquium of Kernforschungszentrum Karlsruhe G.m.b.H.; Karlsruhe, F.R. Germany (10 Mar 1987).

In several small river catchment areas in the northern Black Forest the input and output rates of dissolved species were investigated. Higher concentrations of atmospheric sulphate and nitrate in rainwater are reflected in the hydrochemistry of the surface runoff and groundwater. Flux rates are controlled by regional factors (high values in the northern and northwestern sites) and annual precipitation. Output rates are considerably higher in areas where some geogenic carbonate is present in the sandstones. The nitrate concentration in spring waters derived from shallow groundwater shows a seasonal variation. Significant chemical alterations do not become evident until the water has passed the Bunter Sandstone. In the Upper Bunter Sandstone the protons are buffered by carbonates. A balance calculation shows that sulphate appears to be stored in the pedosphere-bedrock system. The higher input of nitrogen and potassium is predominantly included in the increasing biomass. Surface runoff and interflow have a composition similar to spruce throughfall water. In the Middle Bunter Sandstone higher levels of calcium and magnesium in groundwater and lower concentrations of hydrocarbonates can show the effects of cation exchange and increased weathering of silicates.

9514 (UCRL—97356) Solute transport modeling of organic compounds in ground water west of the Lawrence Livermore National Laboratory, Livermore, California. Rogers, L.L. (Lawrence Livermore National Lab., CA (USA)). 31 Aug 1987. Contract W-7405-ENG-48. 9p. (CONF-8710141—3). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88001631/JAW.

From International conference on groundwater contamination; Amsterdam, Netherlands (26 Oct 1987).

This study determined optimal remedial action for the volatile organic plume contaminating ground water in the complex heterogeneous alluvial sediments under the west boundary of the Lawrence Livermore National Laboratory (LLNL) site and vicinity. Simulation-management modeling, a combination of solute transport simulation with linear optimization of well locations and pumpage rates, was done to determine appropriate remedial action. The study uses simulation-management modeling of ground water contaminant transport in an extremely complex geologic regime with poorly understood contaminant sources. Presented here are results from the initial phase of the study, the solute transport modeling of the organic compounds. The finite element ground water flow and contaminant transport code SUTRA was used in areal steady-state simulations. 15 refs., 7 figs., 2 tabs.

5203 Radioactive Materials Monitoring And Transport

REFER ALSO TO CITATION(S) 8524, 8526, 8527, 8543, 8789, 9481, 9482, 9501, 9759, 9760

9515 (AERE-G—3554) Verification and validation of models. June 1984-May 1985. Herbert, A.W.; Hodgkinson, D.P.; Jackson, C.P.; Lever, D.A.; Robinson, P.C. (UKAEA Atomic Energy Research Establishment, Harwell. Theoretical Physics Div.). Jul 1985. 18p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88750686/JAW.

Mathematical models for groundwater flow and radionuclide transport have been tested for numerical accuracy (verification) and their ability to describe experimental data (validation). In addition, ways of using models in performance assessments which take account of uncertainties, are being investigated. These objectives are being met by participating in international exercises, by developing bench-mark problems and by analysing experiments. In particular the contract has funded participation in the HYDROCOIN project for groundwater flow models. Three HYDROCOIN test cases have been specified and five have been calculated with encouraging results. Also, analytical solutions to the three-dimensional radionuclide transport equation have been derived and used to verify the accuracy of the finite-element code NAMSOL. Finally, a verification exercise for fracture network models has been successfully carried out in cooperation with the Lawrence Berkeley Laboratory.

9516 (FLPU—85-2) Dissolved helium, inert gases, radium and radon in groundwaters from the Altnabreac research site. Andrews, J.N.; Kay, R.L.F. (British Geological Survey, Keyworth. Fluid Processes Research Group). Jan 1985. 56p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE88750702/JAW.

A groundwater geochemical study has been carried out at Altnabreac, Cenithness, Scotland, to investigate the feasibility of disposal of high-level radioactive wastes in crystalline rock. A groundwater flow model was constructed for sampling a section at depths up to 300 m. Measurements of inert gases dissolved in groundwaters are used, with parallel measurements of ^{14}C, tritium, oxygen and hydrogen isotopes to infer groundwater ages and residence times.

9517 $U0_2$2i-humate interactions in soft, acid, humate-rich waters. Giesy, J.P.; Geiger, R.A.; Kevern, N.R.; Alberts, J.J. (Michigan State Univ., East Lansing, USA. Dept. of Fisheries and Wildlife; Savannah River Ecology Lab., Aiken, SC, USA). *Journal of Environmental Radioactivity (London);* 4: No. 1, 39-64(1986). Contract AC09-76SR00819.

Few analytical techniques are sensitive enough to detect environmental concentrations of uranium in waters where humic acids are present. A technique was devised for measuring humic-com-

plexed and uncomplexed uranium at these concentrations. Free UO_2^{2+} was separated from bound by chelating resin; the C - C bonds were destroyed by photo-oxidation and UO_2^{2+} was quantified by laser fluorometry. The binding capacity (BC) of 3.5 mg C liter^{-1} Aldrich humic acid solution was estimated to be 1.14×10^{-6} M UO_2^{2+}. A Gaussian-Scatchard model was used to estimate the overall conditional stability constant for uranium concentrations of 5.25×10^{-8} M to 2.1×10^{-7} M in the presence of 3.5 mg liter^{-1} humate. The estimates of the mean amd standard deviation for the log of the stability constants were 6.5 and 0.8, respectively. When these mean and standard deviations were used to determine the mole-average number of binding sites at three points on the Gaussian distribution, the estimators of log-stability constants were found to be: $K_1 = 5.2$, $K_2 = 6.5$ and $K_3 = 7.7$. The thermodynamic, geochemical simulation model GEOCHEM and the three-component Gaussian -Scatchard estimates allowed accurate prediction of the relative proportion of UO_2^{2+} bound to humates for a soft water pond across the entire range of metal-ligand ratios studied. Approximately 22% of the UO_2^{2+} was predicted to be associated with dissolved organic carbon.

5205 Site Resource And Use Studies

REFER ALSO TO CITATION(S) 8664, 9510

5206 Regulations

REFER ALSO TO CITATION(S) 8466, 8664, 9007

55 BIOMEDICAL SCIENCES, BASIC STUDIES

5501 Behavioral Biology

REFER ALSO TO CITATION(S) 9557

5502 Biochemistry

REFER ALSO TO CITATION(S) 8692, 9544, 9546, 9758, 9883, 9892, 9896, 9897, 9898, 9912, 9946, 9947, 9950, 9956

9518 **(DOE/ER/10682—1) Biochemical and biophysical studies of the E. coli aerobic respiratory chain: Annual performance report for the period September 1, 1986 to August 31, 1987.** Gennis, R.B. (Illinois Univ., Urbana (USA)). Aug 1987. Contract AC02-80ER10682. 4p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88000153/JAW.

The molecular characterization of components of the aerobic respiratory chain of Escherichia coli was sought by study of the two terminal oxidase complexes, called the cytochrome o complex. We previously purified this enzyme and cloned the gene. Recently we have obtained the complete DNA sequence of this gene. Studies have been started to clone the gene encoding a second NADH dehydrogenase in E. coli. This is of interest to us because the enzyme must function as a coupling site or proton pump in the membrane.

9519 **(DOE/ER/13339—3) Respiratory enzymes of Thiobacillus ferrooxidans: Progress report, December 1986-November 1987.** Blake, R. II. (Meharry Medical Coll., Nashville, TN (USA)). Nov 1987. Contract FG05-85ER13339. 10p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88002792/JAW.

Our work has established that the rate of the Fe(II)-dependent reduction of rusticyanin is far too slow to be physiologically significant; that the Fe(II)-dependent reduction of rusticyanin shows no anion specificity; and that electron transfer from Fe(II) to rusticyanin may actually be catalyzed by a cytochrome c. These observations are helping to redefine the roles from respiratory chain of T. ferrooxidans. The kinetic methodology developed here provides a means of determining the values of the Km and Vmax for a nonchromogenic substrate by exploiting the effects of the nonchromogenic substrate on the enzymatic transformation of a corresponding chromogenic substrate. These procedures may be applied to any enzyme which catalyzes a strongly exergonic reaction with no appreciable product inhibition. It is anticipated that the kinetic procedure developed here could enjoy a widespread application to problems in biochemistry. On a more practical note, inadequate means of obtaining high cell densities have hindered the progress in both basic and applied research concerning T. ferrooxidans. The preliminary observations that the cell yield of iron-oxidizing bacteria may be dramatically increased as a result of electrolysis holds great promise for both basic and applied research involving this organism. 3 figs.

9520 **(DOE/ER/13367—1) [Corn storage protein: A molecular genetic model]: Progress report for 1985.** (Rutgers--the State Univ., Piscataway, NJ (USA)). 1987. Contract FG05-85ER13367. 5p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE88002794/JAW.

We have focused on the gene structure of storage proteins in maize as a model system for plant genes. These efforts have led to the understanding of the organization of these genes in the maize genome and of the primary structure of their gene products. In particular, we have learned that storage proteins have three domains, unique amino- and carboxy-terminal regions, and a central region that contains a repeated block of amino acides. This repeat contains the amino acid residues that are highly amplified, such as glutamine which is an important nitrogen acceptor. This architecture turns out to be fundamental for all storage proteins studied so far. We are now developing the mechanism by which the methionine content of maize kernels is controlled by the 10 kd zein protein. 5 refs.

9521 **(DOE/ER/13367—2) [Corn storage protein: A molecular genetic model]: Progress report for 1986.** (Rutgers--the State Univ., Piscataway, NJ (USA)). 1986. Contract FG05-85ER13367. 6p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88002795/JAW.

Using corn storage proteins as a molecular model we have found interesting differences in the modulation of gene expression that affect the proline and methionine content in the corn kernel. Recent progress is described using recombinant DNA methodology to study the transcriptional and post transcriptional control of differential gene expression during endosperm development in different allelic variants. 4 refs.

9522 **(DOE/ER/60408—1) Correlation of chromosome patterns in human leukemic cells with exposure to chemicals and/or radiation: Progress report for the period January 1, 1987 through August 15, 1987.** Rowley, J.D. (Chicago Univ., IL (USA)). Aug 1987. Contract FG02-86ER60408. 7p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE87014048/JAW.

The use of in situ hybridization and pulse field gel electrophoreses and its various modifications provides us with very powerful tools to understand the nature of the deletion of 5q in human acute leukemia. The availability of cells from these patients, both leukemic as well as normal cells, will allow us to translate the genetic map of 5q into a precise analysis of the DNA from these affected patients. 11 refs., 1 fig., 1 tab.

9523 **Bacterial δ-aminolevulinic acid synthase activity is not essential for leghemoglobin formation in the soybean/Bradyrhizobium japonicum symbiosis.** Guerinot, M.L.; Chelm, B.K. (Michigan State Univ., East Lansing). *Proceedings of the National Academy of Sciences of the United States of America;* **83**: No. 6, 1837-1841(Mar 1986). Contract AC02-76ER01338.

Previous studies of legume nodules have indicated that formation of the heme moiety of leghemoglobin is a function of the bacterial symbiont. The authors now show that a hemA mutant of Bradyrhizobium japonicum that cannot carry out the first step in heme biosynthesis forms fully effective nodules on soybeans. The bacterial mutant strain was constructed by first isolated the wild-type hemA gene encoding δ-aminolevulinic acid synthase (EC 2.3.1.37) from a cosmid library, using a fragment of the Rhizobium meliloti hemA gene as a hybridization probe. A deletion of the hemA gene region, generated in vitro, then was used to construct

the analogous chromosomal mutation by gene-directed mutagenesis. The mutant strain had no δ-aminolevulinic acid synthase activity and was unable to grow in minimal medium unless δ-aminolevulinic acid was added. Despite its auxotrophy, the mutant strain incited nodules that appeared normal, contained heme, and were capable of high levels of acetylene reduction. These results rule out bacterial δ-aminolevulinic acid synthase activity as the exclusive source of δ-aminolevulinic acid for heme formation in soybean nodules.

9524 **Molecular recognition of DNA binding agents: High-field ^{1}H and ^{31}P one- and two-dimensional NMR studies on the 1:1 intercalation complexes of mitoxantrone with selected oligodeoxyribonucleotides.** Otter, A.; Hanstock, C.C.; Kotovych, G.; Rayner, B.; Vasseur, J.J.; Imbach, J.L.; Lown, J.W. (Univ. of Alberta, Edmonton; Universite des Sciences et Techniques du Languedoc, Montpellier, France). pp 211-218 of Mechanisms of DNA damage and repair: Implications for carcinogenesis and risk assessment. Simic, M.G.; Grossman, L.; Upton, A.C. (eds.). New York, NY; Plenum Press (1986). (CONF-850663—).

From International conference on DNA damage and repair - implications for carcinogenesis and risk assessment; Gaithersburg, MD, USA (3 Jun 1985).

There is increasing knowledge from molecular biology of gene expression and control, DNA structure and topology and the recognition of sequences of unusual susceptibility to xenobiotics. This new information increases the prospects for rational anticancer drug design provided one can determine the structural factors controlling molecular recognition and binding. The techniques that have been applied to drug complexation in the past include electron microscopy and x-ray diffraction for studying solid state behavior. NMR is potentially one of the more valuable techniques to provide detailed information on the structure of DNA complexes in solution. Until recently, however, progress has been slow owing to the complexity of ^{1}H-NMR spectra of oligodeoxyribonucleotides. However, the advent of cryospectrometers and the development of 2D-techniques permitted applications including COSY, SECSY, HH-INADEQUATE, J-resolved, and NOESY which have been valuable in more detailed analysis of oligonucleotides. The analysis of the ^{1}H-NMR spectra of drug:DNA complexes poses additional problems both in the complexity of the resulting spectra and, more particularly, in the line broadening resulting from equilibrium binding. Further progress thus depends both on the careful selection of significant agents which bind sufficiently strongly to give well resolved spectra and on the development of new NMR techniques to permit reliable assignments. 37 refs., 6 figs., 1 tab.

9525 **Novel types of DNA-sugar damage in neocarzinostatin cytotoxicity and mutagenesis.** Goldberg, I.H. (Harvard Medical School, Boston, MA). pp 231-244 of Mechanisms of DNA damage and repair: Implications for carcinogenesis and risk assessment. Simic, M.G.; Grossman, L.; Upton, A.C. (eds.). New York, NY; Plenum Press (1986). (CONF-850663—).

From International conference on DNA damage and repair - implications for carcinogenesis and risk assessment; Gaithersburg, MD, USA (3 Jun 1985).

Although a number of antitumor antibiotics interact with DNA to form covalent adducts with the bases, relatively few damage DNA by interacting with the deoxyribose moiety. Neocarzinostatin (NCS), a member of a family of macromolecular antibiotics obtained from filtrates of Streptomyces, is such an agent. Many of the biochemical and cellular effects of NCS resemble those of ionizing radiation. Most, possibly all, of the DNA lesions caused by NCS appear to result from the direct attack of an activated form of the drug on the deoxyribose of DNA. This is to be contrasted with ionizing radiation or the antibiotic bleomycin, that damage DNA deoxyribose through the intervention of a reduced form of oxygen. This paper describes the nature of the interaction between the active component of NCS and DNA, on the mechanism of the ensuing deoxyribose damage, and on some of the biological consequences of these actions. 24 refs., 7 figs.

9526 **DNA-drug binding and control of genetic information.** Dickerson, R.E. (Univ. of California, Los Angeles). pp 245-255 of Mechanisms of DNA damage and repair: Implications for carcinogenesis and risk assessment. Simic, M.G.; Grossman, L.; Upton, A.C. (eds.). New York, NY; Plenum Press (1986). (CONF-850663—).

From International conference on DNA damage and repair - implications for carcinogenesis and risk assessment; Gaithersburg, MD, USA (3 Jun 1985).

Our immediate goals are to use DNA oligonucleotide synthesis and x-ray crystal structure analysis to study the molecular basis for the interaction of groove-binding and intercalating antitumor antibiotics with double-helical DNA, and then to use this information to design more efficient DNA-binding agents, including ones capable of recognizing particular sequences of ten or more base pairs. This work is a logical extension of our recent x-ray structure analysis of the complex of netropsin, a minor groove binding drug that recognizes and binds to regions of A:T base pairs, with a B-DNA dodecamer of sequence: CGCGAATTCGCG. Groove-binding drugs probably are more promising candidates for the design of sequence-specific DNA-binding agents than are intercalators, because the information about base sequence resides in the hydrogen bond donor and acceptor atoms at the edges of the bases on the floor of the major and minor grooves. From these studies should come new analogues of the present drugs, such as netropsin, and possibly other sequence-specific groove-binding drugs, with entirely new backbones, that can be targeted toward particular base sequences. Relatively few DNA-binding antitumor drugs show clear evidence of base sequence specificity - the ability to recognize and bind to one base sequence in preference to another, as do repressors and other DNA control proteins. Actinomycin D intercalates best between bases of sequence GC, and bleomycin prefers GC or GT. Netropsin and distamycin are unusually specific, exhibiting strong preference for regions of four or more A:T base pairs, in double-helical B-DNA only. 44 refs., 6 figs.

9527 **Differential expression of SOS genes in an E. coli mutant producing unstable lexA protein enhances excision repair but inhibits mutagenesis.** Peterson, K.R.; Ganesan, A.K.; Mount, D.W. (Univ. of Arizona, Tucson; Stanford Univ., CA). pp 265-271 of Mechanisms of DNA damage and repair: Implications for carcinogenesis and risk assessment. Simic, M.G.; Grossman, L.; Upton, A.C. (eds.). New York, NY; Plenum Press (1986). (CONF-850663—).

From International conference on DNA damage and repair - implications for carcinogenesis and risk assessment; Gaithersburg, MD, USA (3 Jun 1985).

The SOS response is displayed following treatments which damage DNA or inhibit DNA replication. Two associated activities include enhanced capacity for DNA repair resulting from derepression of the recA, uvrA, uvrB and uvrD genes and increased mutagenesis due to derepression of recA, umuC and umuD. These changes are the consequence of the derepression of at least seventeen unlinked operons negatively regulated by LexA repressor. Following treatments that induce the SOS response, a signal molecule interacts with RecA protein, converting it to an activated form. Activated RecA protein facilitates the proteolytic cleavage of LexA repressor, which results in derepression of the regulon. The cell then enters a new physiological state during which time DNA repair processes are augmented. The lexA41 mutant of E. coli is a uv-resistant derivative of another mutant, lexA3, which produces a represesor that is not cleaved following inducing treatments. The resultant protein is unstable. Lac operon fusions to most of the genes in the SOS regulon were used to show that the various damage-inducible genes were derepressed to different extents. uvrA, B, and D were almost fully derepressed. Consistent with this finding, the rate of removal of T4 endonuclease V-sensitive sites was more rapid in the uv-irradiated lexA41 mutant than in normal cells, suggesting a more active excision repair system. We propose that the instability of the LexA41 protein reduces the intracellular concentration of repressor to a level that allows a high level of excision repair. The additional observation that SOS mutagenesis was only weakly induced in a lexA41 uvrA^{-} mutant implies that the mutant protein partially represses one or more genes whose products promote SOS mutagenesis. 17 refs., 4 figs., 1 tab.

9528 Mutagenic DNA repair in bacteria: The role of umuDC and mucAB. Marsh, L.; Walker, G.C. (Massachusetts Institute of Technology, Cambridge). pp 273-280 of Mechanisms of DNA damage and repair: Implications for carcinogenesis and risk assessment. Simic, M.G.; Grossman, L.; Upton, A.C. (eds.). New York, NY; Plenum Press (1986). (CONF-850663—).

From International conference on DNA damage and repair - implications for carcinogenesis and risk assessment; Gaithersburg, MD, USA (3 Jun 1985).

A specific mutation (muc*) in cloned mucAB changes the gly at codon 16 of mucA to a glu. This mutant muc alters the mutagenic spectrum. Reversion of the argE3 or his-4 ochre mutations of E. coli provides a crude but useful system for looking at mutagenic spectrum changes, since revertants at the site of the original mutation are easily distinguished from induced ochre suppressor mutations. The ratio of gene specific revertants to total revertants in excision repair proficient and deficient strains was determined. In these experiments the only difference between the two strains is a single mutation in the cloned muc genes and overall reversion frequencies are similar. Clearly this mutation can change the specificity of at least this simple test system independently of the excision repair status of the strain that it is in. It is interesting to note that in both of the cases mentioned potential hairpin structures can form at one of the two sites being compared: in lacI around internal palidromes within the gene and in the arg/sup oc/ reversion system at the tRNA genes. Such potential hairpins might be hotspots for mutagenesis. In any case muc and umu may contribute to specificity of mutagenesis at least at some sites. This suggests an interaction with the lesion or the DNA around it. At other sites the spectrum of recovered mutants may be most determined by the spectrum of damage or the relative efficiency of repair. 31 refs., 3 figs.

9529 The repair of pyrimidine dimers via a DNA-glycosylase mechanism. Grafstrom, R.H. (Thomas Jefferson Univ., Philadelphia, PA). pp 281-286 of Mechanisms of DNA damage and repair: Implications for carcinogenesis and risk assessment. Simic, M.G.; Grossman, L.; Upton, A.C. (eds.). New York, NY; Plenum Press (1986). (CONF-850663—).

From International conference on DNA damage and repair - implications for carcinogenesis and risk assessment; Gaithersburg, MD, USA (3 Jun 1985).

The endonuclease isolated either from M. luteus or bacteriophage T4 infected E. coli (the denV gene product) consists of two enzymatic activities on a single polypeptide chain: a pyrimidine dimer-DNA glycosylase and an AP endonuclease. The repair of pyrimidine dimers by this enzyme is initiated by the cleavage of the N-glycosylic bond of the 5′ pyrimidine of the dimer that leaves the cyclobutane dimer still attached to the DNA through the N-glycosylic bond of the 3′ pyrimidine of the dimer. This reaction results in the formation of an apyrimidinic site in the DNA. The second step in this repair pathway is the endonucleolytic cleavage of the DNA 3′ to the AP site by the associated AP endonuclease. As a result, the nicked DNA contains DNA damage on both sides of the incision site: an apyrimidinic moiety on the 3′ end and a thymine-thymidylate dimer on the 5′ end. The enzymes prefer double stranded DNA over single stranded DNA, and thymine over cytosine at the 5′ position of the dimer. The AP endonuclease activity prefers the AP site created by the pyrimidine dimer-DNA glycosylase on uv irradiated DNA over either apurinic or apyrimidinic DNA. This repair mechanism appears to be operative in vivo since DNA intermediates containing thymine-thymidylate dimer sites have been detected in uv irradiated T4 infected E. coli and in uv irradiated M. luteus. The cloned denV gene partially complements the uv repair deficient uvr A,B,C strains of E. coli. 25 refs., 1 fig.

9530 The involvement of an E. coli multiprotein complex in the complete repair of uv-damaged DNA. Grossman, L.; Caron, P.R.; Oh, E.Y. (Johns Hopkins Univ., Baltimore, MD). pp 287-294 of Mechanisms of DNA damage and repair: Implications for carcinogenesis and risk assessment. Simic, M.G.; Grossman, L.; Upton, A.C. (eds.). New York, NY; Plenum Press (1986). (CONF-850663—). Contract AC02-76EV02814.

From International conference on DNA damage and repair - implications for carcinogenesis and risk assessment; Gaithersburg, MD, USA (3 Jun 1985).

The bimodal nature of the E. coli uvrABC catalyzed incision reaction of uv irradiated DNA leads to potential excision of a 12 to 13 base long damaged fragment. However, the oligonucleotide fragment containing the uv-induced pyrimidine dimer is not released under non-denaturing in vitro reaction conditions. The uvrABC proteins, also, are stably bound to the incised DNA and do not turn over following the incision event. In this communication it is shown that damaged fragment release from the parental uvrABC incised DNA is dependent on either chelating conditions or upon the simultaneous addition of the uvrD gene product (helicase II) and the polA gene product (DNA polymerase I) when catalyzing concommitant polymerization of deoxynucleoside triphosphate substrates. The product of this multiprotein catalyzed series of reactions serves as a substrate for polynucleotide ligase which results in the restoration of the integrity of the strands of DNA. The addition of the uvrD protein to the incised DNA-uvrABC complex also results in turnover of only the uvrC protein. It is suggested that the repair processes of incision, excision, resynthesis and ligation are coordinately catalyzed by a protective complex of proteins in a 'repairosome' type of configuration. 33 refs., 3 figs.

9531 Mismatch correction. Modrich, P. (Duke Univ. Medical Center, Durham, NC). pp 303-310 of Mechanisms of DNA damage and repair: Implications for carcinogenesis and risk assessment. Simic, M.G.; Grossman, L.; Upton, A.C. (eds.). New York, NY; Plenum Press (1986). (CONF-850663—).

From International conference on DNA damage and repair - implications for carcinogenesis and risk assessment; Gaithersburg, MD, USA (3 Jun 1985).

The study of homologous genetic recombination led to the initial suggestion that the occurrence and processing of mismatched base pairs may be of biological significance. Genetic recombination occurs by breakage and rejoining of two homologous helics and is thought to proceed via an intermediate DNA species containing a heteroduplex joint, a region in which the two DNA strands are derived from different parental helices. If the heteroduplex joint spans genetic differences between the recombining molecules, then this region will contain one or more mispaired bases and will be genetically heterozygous. DNA biosynthetic errors may also contribute significantly to the generation of mispaired bases and that mismatch correction limited to the newly synthesized strand could serve to enhance replication fidelity. Strand discrimination may be based on DNA methylation. Newly synthesized strands are expected to be transiently under-methylated and thus distinguishable from parental template strands. The idea that strand-specific mismatch correction contributes to replication fidelity has gained substantial support, at least in bacterial systems. Evidence to this effect is summarized here. In order to approach the mechanism of mismatch correction in E. coli, we have developed a cell-free system which supports the reaction in vitro. The assay employed in this work monitors repair of mismatched base pairs within the single EcoRI site of bacteriophage fl R229 heteroduplexes. Since this DNA also contains four d(G-A-T-C) sites, the state of methylation of which can be controlled, this molecule can also be used to address the methyl-dependence in in vitro correction.

9532 Molecular approaches to the study of nucleotide excision repair in eukaryotes. Friedberg, E.C.; Barbis, D.P.; Chenevert, J.M.; Fleer, R.; Kalainov, D.; Naumovski, L.; Nicolet, C.M.; Robinson, G.W.; Schultz, R.A.; Weiss, W.A. (Stanford Univ. Medical Center, CA). pp 311-318 of Mechanisms of DNA damage and repair: Implications for carcinogenesis and risk assessment. Simic, M.G.; Grossman, L.; Upton, A.C. (eds.). New York, NY; Plenum Press (1986). (CONF-850663—). Contract AT03-76EV70032.

From International conference on DNA damage and repair - implications for carcinogenesis and risk assessment; Gaithersburg, MD, USA (3 Jun 1985).

Very little is known about the molecular mechanism of nucleotide excision repair in eukaryotes. Studies on human cells have been stimulated by the availability of excision repair-defective cell

lines from patients suffering from the autosomal recessive disease xeroderma pigmentosum (XP). Such studies have contributed significantly to an understanding of the genetic complexity of excision repair in human cells. However, to date, no human excision repair genes or gene products known to complement the repair defect in XP cells have been isolated. The yeast Saccharomyces cerevisiae is an interesting model for exploring the molecular mechanism of nucleotide excision repair in eukaryotic cells. As is true in human cells, multiple yeast genes are involved, and at least five genes are required for the specific incision of uv-irradiated DNA in vivo. These five genes have been isolated by molecular cloning, and the nucleotide sequences of four of them have been determined. Each of these cloned genes is being used for overexpression of protein. 37 refs., 1 fig., 2 tabs.

9533 Restoration of DNA repair in uv-sensitive Chinese hamster ovary cell by the denV gene from bacteriophage T4. Valerie, K.; de Riel, J.K.; Henderson, E.E. (Temple Univ. School of Medicine, Philadelphia, PA). pp 319-326 of Mechanisms of DNA damage and repair: Implications for carcinogenesis and risk assessment. Simic, M.G.; Grossman, L.; Upton, A.C. (eds.). New York, NY; Plenum Press (1986). (CONF-850663—).

From International conference on DNA damage and repair - implications for carcinogenesis and risk assessment; Gaithersburg, MD, USA (3 Jun 1985).

The denV gene of bacteriophage T4, which is the principal determinant of resistance to ultraviolet light on the T4 genome, codes for endonuclease V, a protein possessing two distinct enzymatic activities which can act sequentially to initiate repair of pyrimidine dimers. A pyrimidine dimer-DNA glycosylase activity first cleaves one of the two bonds attaching the pyrimidine dimer to the DNA backbone, leaving an apyrimidinic site, and an AP-endonuclease activity of the same polypeptide, then introduces a single-strand break at this site. Endonuclease V leaves residual damage products on both sides of the single-strand break which must be removed by other enzymes before repair synthesis can take place. Experiments with permeabilized cells have shown that endonuclease V is capable of restoring excision repair of uv damage not only in repair-deficient E. coli but also in human fibroblasts from patients with the heritable uv repair disorder xeroderma pigmentosum. Thus the denV gene is an interesting candidate for genetic correction of uv repair deficiency in both prokaryotic and eukaryotic cells. We have cloned the denV gene and shown that it does in fact partially restore uv resistance in a variety of repair-deficient E. coli strains. Here we present data which show that the denV gene, coupled to an SV40 early gene promoter, restores repair of uv damage in the uv-sensitive Chinese hamster ovary cell line UV5. 18 refs., 4 figs.

9534 The adaptive response of mammalian cells to alkylating agents. Samson, L. (Harvard School of Public Health, Boston, MA). pp 327-334 of Mechanisms of DNA damage and repair: Implications for carcinogenesis and risk assessment. Simic, M.G.; Grossman, L.; Upton, A.C. (eds.). New York, NY; Plenum Press (1986). (CONF-850663—).

From International conference on DNA damage and repair - implications for carcinogenesis and risk assessment; Gaithersburg, MD, USA (3 Jun 1985).

We devised a way to study continuous low-dose bacterial mutagenesis in an attempt to simulate chronic environmental exposure to mutagens. Our objective was to determine whether mutation induction occurred with the frequency and the kinetics one would predict from the usual mutagenesis studies involving exposing cells to extremely large doses of mutagen for a short period. We compared mutations induced during several days of mutagen exposure with mutations induced during several minutes of mutagen exposure. We chose to study N-methyl-N'-nitro-nitrosoguanidine (MNNG). The results were totally unexpected. A growing E. coli population continuously exposed to a low MNNG dose (1 ug/ml) for three days did not continuously accumulate mutant cells, but became refractory to mutation induction after 60 min exposure. Exposure of E. coli to sub-lethal levels of MNNG was found to induce de novo synthesis of at least two DNA repair enzymes that protected against the mutagenic effects of very high doses of MNNG. 10 refs., 7 figs.

9535 DNA glycosylases in DNA repair. Lindahl, T. (Imperial Cancer Research Fund, South Mimms, United Kingdom). pp 335-340 of Mechanisms of DNA damage and repair: Implications for carcinogenesis and risk assessment. Simic, M.G.; Grossman, L.; Upton, A.C. (eds.). New York, NY; Plenum Press (1986). (CONF-850663—).

From International conference on DNA damage and repair - implications for carcinogenesis and risk assessment; Gaithersburg, MD, USA (3 Jun 1985).

The alternative pathway of excision-repair of DNA is initiated by one of several DNA glycosylases, which catalyze cleavage of the base-sugar bond of an altered nucleotide residue to release the damaged base component in free form and leave a repairable apurinic or apyrimidinic site in the DNA. Some observations on the multiplicity and substrate specificity of these enzymes are discussed here. Several different types of base damage in DNA may be excised by currently unknown DNA glycosylases. It is unclear how damaged cytosine residues are removed. Further, the repair of N-oxides or naphthylamine adducts has not been investigated. The limiting factor for experimental work in these cases is that the chemical characterization of the base derivatives is incomplete, and they are consequently not available as reference compounds for enzymological studies. The physiological roles of several of the known DNA glycosylases are being defined by isolation of enzyme-deficient mutants, and by detailed characterization of the substrate specificities of the enzymes. The least well understood of the DNA glycosylases is the hypoxanthine-DNA glycosylase. While the apparently narrow substrate specificity indicates that the enzyme could serve to remove deaminated adenine residues from DNA, the very low activity in E. coli extracts implies that the enzyme might act more efficiently on a different, so far unrecognized, lesion. Mammalian cell extracts contain markedly higher levels of hypoxanthine-DNA glycosylase activity than bacteria. The genes for most of the known DNA glycosylases of E. coli have already been cloned, and in some cases sequenced, and with time these studies will no doubt be extended to the analogous enzymes of mammalian cells. 29 refs.

9536 Apurinic sites as common intermediates in mutagenesis. Loeb, L.A.; Preston, B.D.; Snow, E.T.; Schaaper, R.M. (Univ. of Washington, Seattle; National Institute of Environmental Health Sciences, Research Triangle Park, NC). pp 341-347 of Mechanisms of DNA damage and repair: Implications for carcinogenesis and risk assessment. Simic, M.G.; Grossman, L.; Upton, A.C. (eds.). New York, NY; Plenum Press (1986). (CONF-850663—).

From International conference on DNA damage and repair - implications for carcinogenesis and risk assessment; Gaithersburg, MD, USA (3 Jun 1985).

How DNA polymerases, with their stringent requirement for correct base pairing, can accommodate bulky adducts to yield mutations in nascent DNA is unknown. One possibility is that the adducts responsible for mutagenesis are labile and form non-bulky intermediary products that are mutagenic. We propose that apurinic sites are mutagenic intermediates and have analyzed their mutagenic potential in vivo and in vitro. Apurinic sites result from the hydrolysis of the glycosylic bond between a purine base and the deoxyribose sugar leaving the DNA phosphodiester backbone intact. Depurination of DNA appears to occur at the rate of approximately 4×10^{-11} depurinations/nucleotide residue/sec. This rate translates to about 10,000 depurinations per mammalian cell per day. If apurinic sites are present in DNA, bypass of these sites during DNA replication is likely to involve non-template directed incorporation of nucleotides by DNA polymerases. However, the concept of apurinic sites as promutagenic lesions was not supported by initial experiments. Only recently have studies documented the mutagenic potential of apurinic sites and pointed to the possibility that depurination is a major mechanism for spontaneous and induced mutagenesis. 34 refs., 1 fig.

9537 The repair of uracil-containing DNA. Weiss, B.; El-Hajj, H.H. (Johns Hopkins Univ. School of Medicine, Baltimore, MD). pp 349-356 of Mechanisms of DNA damage and repair: Implications for carcinogenesis and risk assessment. Simic, M.G.; Grossman, L.; Upton, A.C. (eds.). New York, NY; Plenum Press (1986). (CONF-850663—).

From International conference on DNA damage and repair - implications for carcinogenesis and risk assessment; Gaithersburg, MD, USA (3 Jun 1985).

An unresolved metabolic question is why E. coli goes out of its way to make dUTP. The most direct pathway for the biosynthesis of dTMP would be dUDP –> dUMP –> dTMP, instead of dCTP –> dUTP –> dTMP. In the latter pathway not only is a high energy phosphate bond and an amino group wasted, but a potentially harmful intermediate dUTP, is generated. Additional energy will be required for the repair of the DNA into which some of this dUTP will be accidentally incorporated. As discovered in the studies of dut mutants, the turnover of DNA uracil enhances genetic recombination and mutation, which may be desirable for the cell population, and this may be why E. coli makes large amounts of dUTP. 22 refs., 2 figs.

9538 Metabolic consequences of DNA damage: The role of poly (ADP-ribose) polymerase as mediator of the suicide response. Berger, N.A.; Berger, S.J. (Case Western Reserve Univ., School of Medicine, Cleveland, OH). pp 357-363 of Mechanisms of DNA damage and repair: Implications for carcinogenesis and risk assessment. Simic, M.G.; Grossman, L.; Upton, A.C. (eds.). New York, NY; Plenum Press (1986). (CONF-850663—).

From International conference on DNA damage and repair - implications for carcinogenesis and risk assessment; Gaithersburg, MD, USA (3 Jun 1985).

Recent studies show that DNA damage can produce rapid alterations in steady state levels of deoxynucleoside triphosphate pools, for example, MNNG or uv-irradiation cause rapid increases in dATP and dTTP pools without significant changes in dGTP or dCTP pools. In vitro, studies with purified eukaryotic DNA polymerases show that the frequency of nucleotide misincorporation was affected by alterations in relative concentrations of the deoxynucleoside triphosphates. Thus the alterations in dNTP pool sizes that occur consequent to DNA damage may contribute to an increased mutagenic frequency. Poly(ADP-ribose) polymerase mediated suicide mechanism may participate in the toxicity of adenosine deaminase deficiency and severe combined immune deficiency disease in humans. Individuals with this disease suffer severe lymphopenia due to the toxic effects of deoxyadenosine. The lymphocytotoxic effect of adenosine deaminase deficiency can be simulated in lymphocyte cell lines from normal individuals by incubating them with the adenosine deaminase inhibitor, deoxycoformycin. Incubation of such leukocytes with deoxycoformycin and deoxyadenosine results in the gradual accumulation of DNA strand breaks and the depletion of NAD^+ leading to cell death over a period of several days. This depletion of NAD and loss of cell viability were effectively blocked by nicotinamide or 3-amino benzamide. Thus, persistent activation of poly(ADP-ribose) polymerase by unrepaired or recurrent DNA strand breaks may activate the suicide mechanism of cell death. This study provides a basis for the interesting suggestion that treatment with nicotinamide could block the persistent activity of poly(ADP-ribose) polymerase and may help preserve lymphocyte function in patients with adenosine deaminase deficiency. 16 refs., 3 figs., 2 tabs.

9539 DNA damage, DNA repair and induced mutagenesis: Some enzymological and structural considerations. Radman, M. (CNRS - Universite Paris VII, France). pp 365-375 of Mechanisms of DNA damage and repair: Implications for carcinogenesis and risk assessment. Simic, M.G.; Grossman, L.; Upton, A.C. (eds.). New York, NY; Plenum Press (1986). (CONF-850663—).

From International conference on DNA damage and repair - implications for carcinogenesis and risk assessment; Gaithersburg, MD, USA (3 Jun 1985).

Working hypotheses for bypass replication in E. coli must account for the fact that targeted mutations are generated by the replication of damaged parental DNA, such that the viable progeny molecules contain a high proportion of the mutant sequence, the nature of the targeted mutation is influenced by the nature of the lesion, thus diverse base substitution mutations should be possible as well as one base deletion (frameshift) mutations, and low-fidelity replication of undamaged DNA may accompany the "bypass." Recent genetic studies clearly show that the enzymology of bypass replication is complex. The initial idea that untargeted mutagenesis is the necessary consequence of the low-fidelity requirement for the bypass may not hold, because mutants exist which affect only targeted mutagenesis (e.g., umuC,D) or only untargeted mutagenesis (polA, some din mutations, etc.). Two studies implicate DNA polymerase III as being involved, directly or indirectly, in at least the untargeted mutagenesis. Furthermore, the genetically-induced SOS mutator effect (e.g., recA441 mutation) and the uv-induced mutator effect appear to be different. A simplified model, though deficient in enzymology, makes a few specific suggestions about the possible structures of the damaged single-stranded template and of the damaged double-stranded DNA, which are compatible with all three requirements above. 46 refs., 4 figs.

9540 Activation of the c-myc oncogene. Cole, M.D. (Princeton Univ., NJ). pp 399-406 of Mechanisms of DNA damage and repair: Implications for carcinogenesis and risk assessment. Simic, M.G.; Grossman, L.; Upton, A.C. (eds.). New York, NY; Plenum Press (1986). (CONF-850663—).

From International conference on DNA damage and repair - implications for carcinogenesis and risk assessment; Gaithersburg, MD, USA (3 Jun 1985).

Activated forms of the c-myc oncogene have been linked to cell transformation in a variety of mammalian and avian tumors. Several mechanisms of gene activation are described, but each mechanism gives rise to constitutive levels of expression, usually no higher than that found in proliferating normal cells. Thus, activation of the c-myc oncogene appears to require high levels of the c-myc protein, in particular at stages of cell growth and differentiation during which the gene is supposed to be inactive. 43 refs.

9541 Mechanisms of spontaneous mutagenesis: Clues from mutational specificity. Glickman, B.W.; Fix, D.F.; Yatagai, Fumio; Burns, P.A.; Schaaper, R.M. (York Univ., Toronto, Ontario; National Institute of Environmental Health Sciences, Research Triangle Park, NC). pp 425-437 of Mechanisms of DNA damage and repair: Implications for carcinogenesis and risk assessment. Simic, M.G.; Grossman, L.; Upton, A.C. (eds.). New York, NY; Plenum Press (1986). (CONF-850663—).

From International conference on DNA damage and repair - implications for carcinogenesis and risk assessment; Gaithersburg, MD, USA (3 Jun 1985).

The sequencing of 270 spontaneous mutants in the lacI gene of E. coli has provided insights into the relative role of the various pathways of mutagenesis. In addition, the analysis of the specificity of mutation has provided insights into their origin. Deletions, insertions, duplications, frameshift and base substitution events were recovered. Within the various classes of mutational events, often evidence for different mechanisms emerged. For example, frameshifts can result from several diverse mechanisms and most intriguingly, insights into DNA "context" effects is emerging. In the future specific hypotheses concerning the origin of specific classes of mutation will be further examined in strains with altered DNA repair capabilities, and with the aid of specifically altered DNA sequences. The ability to clone and sequence large numbers of mutants opens the door to a radical new approach to our understanding of DNA repair and mutagenesis. 41 refs., 3 figs., 4 tabs.

9542 Intragenomic heterogeneity in DNA damage processing: Potential implications for risk assessment. Hanawalt, P.C. (Stanford Univ., CA). pp 489-498 of Mechanisms of DNA damage and repair: Implications for carcinogenesis and risk assessment. Simic, M.G.; Grossman, L.; Upton, A.C. (eds.). New York, NY; Plenum Press (1986). (CONF-850663—).

From International conference on DNA damage and repair - implications for carcinogenesis and risk assessment; Gaithersburg, MD, USA (3 Jun 1985).

We have documented three examples of heterogeneity in DNA repair in mammalian genomes. In African green monkey kidney cells certain bulky adducts are poorly repaired in the heterochromatic alpha DNA sequences relative to that in the bulk DNA. In Chinese hamster ovary cells an active "housekeeping" gene is proficiently repaired in a background of overall inefficient repair in the genome. In both of these cases the heterogeneity was illustrated in normal cells. In the third example, a hereditary defect

in humans has been shown to cause a deficiency in DNA repair in some domains of the genome selectively. In this case the affected "domains" have yet to be identified and characterized, but our results so far indicate that an essential gene is poorly repaired in that system. 45 refs.

9543 **Intragenomic localization of carcinogen-DNA damage.** Wogan, G.N.; McMahon, G. (Massachusetts Institute of Technology, Cambridge). pp 127-134 of Mechanisms of DNA damage and repair: Implications for carcinogenesis and risk assessment. Simic, M.G.; Grossman, L.; Upton, A.C. (eds.). New York, NY; Plenum Press (1986). (CONF-850663—).

From International conference on DNA damage and repair - implications for carcinogenesis and risk assessment; Gaithersburg, MD, USA (3 Jun 1985).

Adducts formed with DNA by a large number of chemical carcinogens have been chemically characterized. Attempts to construct quantitative relationships between levels of adduction and measurable effects such as mutation or transformation frequency, have been constrained by the assumption that adducts are randomly distributed. However, several lines of evidence indicate that adduct distribution is non-random, and a number of factors associated with localized binding of carcinogens to DNA have been identified. Base compositions of DNA sequences can cause preferential binding of those carcinogens which form adducts only at specific nucleophilic sites. Compounds which form only guanine adducts would obviously be disproportionately concentrated in G-C rich regions of DNA. Factors operative at higher levels of DNA organization have been found to be important determinants of adduct localization in nonrandom fashion. Specific nucleotide sequence in the region immediately surrounding target nucleotides has been shown to affect reactivity and binding levels for several carcinogens. DNA conformation also strongly influences the binding of several carcinogens. Fractionation of chromatin by partial digestion with DNAse I or by microsomal nuclease has revealed a general tendency for carcinogen localization in regions of active transcription compared to bulk DNA, and preferential binding to internucleosomal over nucleosomal core DNA. Preferential binding has also been demonstrated in specific sequences, such as repetitive elements and multicopy genes. 42 refs., 1 tab.

5504 Genetics

REFER ALSO TO CITATION(S) 9520, 9521, 9522, 9531, 9536, 9540, 9541, 9883

9544 **Activation of H-ras-1 oncogenes by chemical carcinogens.** Zarbl, H.; Sukumar, S.; Arthur, A.L.; Martin-Zanca, D.; Barbacid, M. (Frederick Cancer Research Facility, MD). pp 385-397 of Mechanisms of DNA damage and repair: Implications for carcinogenesis and risk assessment. Simic, M.G.; Grossman, L.; Upton, A.C. (eds.). New York, NY; Plenum Press (1986). (CONF-850663—).

From International conference on DNA damage and repair - implications for carcinogenesis and risk assessment; Gaithersburg, MD, USA (3 Jun 1985).

Efforts aimed at establishing the role of ras oncogenes in human neoplasia are complicated by the unknown etiology of most human cancers and the impossibility of experimental manipulations. In animal model systems that closely parallel human neoplasia, we have shown that transforming ras genes can be reproducibly identified in mammary carcinomas of rats induced by the chemical carcinogen nitroso-methyl-urea (NMU). In this article, we discuss the specific activation of the H-ras-1 locus in mammary carcinomas of rats induced by different chemical carcinogens. We provide experimental evidence that the mutagenic activity of the carcinogens utilized is directly responsible for the malignant activation of the H-ras-1 oncogenes. 47 refs., 3 figs., 3 tabs.

5505 Metabolism

REFER ALSO TO CITATION(S) 8690, 9530, 9537, 9538, 9917, 9952, 9953, 9955

9545 **(INIS-mf—10770) Kinetic investigations with /sup 3/H pentacetylgitoxin and /sup 3/H gitoxin on guinea-pigs.** Haeger, G. (Kiel Univ. (Germany, F.R.). Medizinische Fakultaet). 9 Sep 1982. 76p. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88751501/JAW.

After a single intravenous or oral application of /sup 3/H pentaacetylgitoxin (/sup 3/H-PAG) and /sup 3/H gitoxin, the elimination of the radioactivity from the blood plasma of guinea-pigs over a period of 7 days was determined. After intravenous application of /sup 3/H-PAG, the change of albumen binding of the radioactivity, its distribution between organic solvents and plasma water, its concentration in various tissues relative to its concentration in plasma water (T/M quotient) and its elimination via feces and urine, was measured. The concentration of radioactive materials in the derived gall bladder was measured for 6 hours after intravenous injection of /sup 3/H-PAG.

9546 **(INIS-mf—11062) Sixth international symposium on mycotoxins and phycotoxins: book of abstracts.** (Council for Scientific and Industrial Research, Pretoria (South Africa); International Union of Pure and Applied Chemistry). 1985. 155p. (CONF-8507166—). NTIS (US Sales Only), PC A08/MF A01. Order Number DE88700774/JAW.

From 6. international symposium on mycotoxins and phycotoxins; Pretoria, South Africa (22 Jul 1985).

This book contains only summaries of papers.

This book contains only the abstracts of seminars that were delivered on the sixth international symposium on mycotoxins and phycotoxins on 22-25 July 1985 in Pretoria under the auspices of the International Union of Pure and Applied Chemistry (IUPAC) and the South African Council for Scientific and Industrial Research. Subject-coverage includes biosynthesis, metabolism, structure and chemical properties, analysis, biochemical mechanisms, toxicity, and pathology of mycotoxins and phycotoxins.

9547 (INIS-mf—11062, pp vp) **/sup 13/C NMR study of the biosynthesis of secondary metabolites of fusarium culmorum.** Blackwell, B.A.; Miller, J.D.; Greenhalgh, R.; Zamir, L. (Chemistry and Biology Research Institute, Agriculture Canada, Ottawa, Ontario; Institute Armand-Frappier, Universite du Quebec, Ville de Laval, Quebec, Canada). 1985. NTIS (US Sales Only), PC A08/MF A01. Order Number DE88700774/JAW. (CONF-8507166—).

From 6. international symposium on mycotoxins and phycotoxins; Pretoria, South Africa (22 Jul 1985).

9548 (INIS-mf—11062, pp S42) **Biosynthetic studies on mycotoxins using multiple stable isotope labelling and NMR spectroscopy.** Vederas, J.C. (Alberta Univ., Edmonton, Canada. Dept. of Chemistry). 1985. NTIS (US Sales Only), PC A08/MF A01. Order Number DE88700774/JAW. (CONF-8507166—).

From 6. international symposium on mycotoxins and phycotoxins; Pretoria, South Africa (22 Jul 1985).

9549 (INIS-mf—11062, pp vp) **Biosynthetic studies on some polyene mycotoxins.** Vleggaar, R. (Council for Scientific and Industrial Research, Pretoria, South Africa. National Chemical Research Lab.). 1985. NTIS (US Sales Only), PC A08/MF A01. Order Number DE88700774/JAW. (CONF-8507166—).

From 6. international symposium on mycotoxins and phycotoxins; Pretoria, South Africa (22 Jul 1985).

9550 (INIS-mf—11062, pp vp) **Influence of phomopsin and ivalin on steroid hormone binding and MCF-7 cell proliferation.** Van Aswegen, C.H.; Van der Watt, J.J.; Potgieter, H.C.; Vermeulen, N.M.J.; Potgieter, D.J.J.; Lewko, W.M.; Wittliff, J.L. (Dept. of Biochemistry and Institution of Life Sciences, Univ. of Pretoria, South Africa; Dept. of Biochemistry, Cancer Centre, Univ. of Louisville, USA). 1985. NTIS (US Sales Only), PC A08/MF A01. Order Number DE88700774/JAW. (CONF-8507166—).

From 6. international symposium on mycotoxins and phycotoxins; Pretoria, South Africa (22 Jul 1985).

5506 Medicine

REFER ALSO TO CITATION(S) 9245, 9414, 9415, 9750, 9764, 9800, 9801, 9801, 9801, 9801, 9839, 9843, 9844, 9845, 9911, 9920, 10296, 10297

9551 (DOE/ER/60438—T1) **Quantitative studies in radiopharmaceutical science: Progress report, September 1, 1986 through August 31, 1987.** Cooper, M. (Chicago Univ., IL (USA)). Sep 1987. Contract FG02-86ER60438. 25p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE87014473/JAW.

The reports in the study were processed separately for the data bases. Research involved attempts to improve PET imaging and diagnostic techniques in man. The primary radiopharmaceutical used was a form of fluorodeoxyglucose. (TEM)

9552 (DOE/ER/60438—T1, pp vp, Paper 1) **F-18 chemistry.** Gatley, S.J. Sep 1987. NTIS, PC A03/MF A01. Order Number DE87014473/JAW.

In Quantitative studies in radiopharmaceutical science: Progress report, September 1, 1986 through August 31, 1987.

We developed a rapid analytical procedure for 2-fluorodeoxyglucose (2FDG) based on the use of the commercially available isolated-enzyme hexokinase, which has several advantages over chromatographic analysis, especially for the new generation of turn-key PET centers. In the new synthetic procedure the new analytical method is particularly suitable for interfacing with an automated synthetic unit. We refined our procedure, based on generation of fluorotri-methylsilane, for recovering unreacted F-18 from reaction mixtures, which is extremely useful for obtaining F-18 for exploratory work. 2 figs., 1 tab.

9553 (DOE/ER/60438—T1, pp vp, Paper 2) **Radiopharmaceuticals for studies of the central dopaminergic system.** DeJesus, O.T.; Mukherjee, J. Sep 1987. NTIS, PC A03/MF A01. Order Number DE87014473/JAW.

In Quantitative studies in radiopharmaceutical science: Progress report, September 1, 1986 through August 31, 1987.

This project developed routine procedures for the preparation of radiotracers that would be useful probes for the CNS dopaminergic system. We have previously prepared and evaluated Br-75 (or Br-76) labelled analog of SCH 23390, a selective D1 receptor antagonist. Because of the relatively rapid pharmacokinetics of SCH 23390, C-11 was also found to be adequate. The synthesis of C-11-SCH 23390 was recently reported and we have performed in vivo experiments to further evaluate C-11-SCH23390. 2 figs., 2 tabs.

9554 (DOE/ER/60438—T1, pp vp, Paper 3) **Maximum likelihood estimation of functional parameters using dynamic data in positron emission tomography.** Chen, C.T. Sep 1987. NTIS, PC A03/MF A01. Order Number DE87014473/JAW.

In Quantitative studies in radiopharmaceutical science: Progress report, September 1, 1986 through August 31, 1987.

More extended EM algorithms that incorporate various physical and statistical physical factors affecting quantitative measurements in tracer kinetic studies have been developed. Factors that have been considered include Poisson process of photon emission, physical decay, photon attenuation, random coincidence and scattered radiation. Computer codes for estimating cerebral blood flow based on various steady-state and rapid administration techniques using oxygen 15 labeled CO_2 or O2 have been completed. Preliminary results indicate that the bolus water injection method is perhaps the first method of our choice for protocol implementation. Software development for blood volume studies using CO is nearly complete. We have developed a method based on computer matching of surfaces as identified in multiple imaging scans which allows registration of any number of scans from single or multiple modalities.

9555 (DOE/ER/60438—T1, pp vp, Paper 4) **Cerebral glucose transport and metabolism with dynamic PET.** Holden, J. Sep 1987. NTIS, PC A03/MF A01. Order Number DE87014473/JAW.

In Quantitative studies in radiopharmaceutical science: Progress report, September 1, 1986 through August 31, 1987.

A comprehensive model describing the response of the steady-state tissue distribution of glucose to changes in plasma glucose concentration was developed. In the model, the steady-state glucose content can be used to predict the steady-state distribution spaces of both phosphorylatable and non-phosphorylatable glucose analogs, and thus the value of the lumped constant (LC) required to convert measured rates of analog metabolism to the desired rate of glucose metabolism. Models of the sensitivity of the kinetic rate constants for phosphorylatable glucose analogs to tissue glucose content were developed. The use of the measured distribution space of a non-phosphorylatable analog such as methyl glucose as an indicator of the LC, is only useful for hyperglycemia. We determined that a particular aspect of the kinetics of phosphorylatable analogs, the ratio of the phosphorylation rate constant to the membrane transport rate constant, is very sensitive to glucose content over the entire physiological range of values. Considerable effort is being made to optimize the use of venous blood that is "arterialized" by limb warming methods. Similarly, final refinements have been made to the non-linear least squares fitting routines, allowing for blood-borne radioactivity and for the loss of phosphorylation product.

9556 (DOE/ER/60438—T1, pp vp, Paper 5) **The regulation of cerebral glucose uptake and metabolism in normal and diabetic man.** Polonsky, K. Sep 1987. NTIS, PC A03/MF A01. Order Number DE87014473/JAW.

In Quantitative studies in radiopharmaceutical science: Progress report, September 1, 1986 through August 31, 1987.

The effects of changes in serum insulin and glucose on brain glucose metabolism using PET technology were investigated. Eight normal, right-handed, male subjects were studied on three separate occasions at least one week apart. In each subject a PET scan was performed under three different metabolic circumstances: basal conditions after an overnight fast, euglycemic clamp, and hypoglycemic clamp in which the plasma glucose was maintained at 55 mg/dl. Exogenous insulin was infused at the same rate in the euglycemic and hypoglycemic clamp studies. In the latter study, the concomitant glucose infusion rate was reduced to allow the plasma glucose concentration to fall to the desired level of mild hypoglycemia. During each study, dynamic positron emission tomography was used to characterize cerebral uptake and distribution of the Fluorine-18 2-deoxyglucose radiotracer as a function of time. Analysis of the brain uptake curve and tracer input function provided rate constants for transport and phosphorylation in accord with a 3 compartmental model (Sokoloff, 1979). Dynamic scans were performed on each study occasion allowing individual rate constants to be studied. In addition to the brain uptake curves, plasma glucose, F-18 2DG levels and counterregulatory hormone values were determined from frequent arterialized venous blood samples.

9557 (DOE/ER/60438—T1, pp vp, Paper 6) **Metabolic correlates of cognitive function language and memory in normal and impaired subjects.** Metz, J. Sep 1987. NTIS, PC A03/MF A01. Order Number DE87014473/JAW.

In Quantitative studies in radiopharmaceutical science: Progress report, September 1, 1986 through August 31, 1987.

This report describes progress in understanding the cognitive function in man. One study attempted to distinguish psychiatric patients from apparently normal individuals based on their metabolism of fluorodeoxyglucose (FDG) by the frontal cortex of the brain. Another study tested the uptake of FDG in apparently normal individuals performing designated tasks. A third study matched the uptake of FDG in Alzheimers patients with apparently normal control patients. The results of additional case studied are mentioned. (TEM)

9558 (DOE/ER/60438—T1, pp vp, Paper 7) **PET scan study of cerebral gliomas and their response to photon and neutron beam radiation therapy.** Halpern, H. Sep 1987. NTIS, PC A03/MF A01. Order Number DE87014473/JAW.

In Quantitative studies in radiopharmaceutical science: Progress report, September 1, 1986 through August 31, 1987.

We have proposed to use H_2 ^{15}O and 2FDG to monitor changes occurring in human cerebral gliomas as a consequence of radiation therapy with neutrons or photons. Our specific aims are to characterize oxidative metabolism of glucose in human cerebral gliomas, and to relate observed changes as sequelae of radiation therapy with neutrons or photons. We correlate 2FDG studies with subtle neuropsychological changes induced by radiation treatment of nominally normal brain parenchymal tissues through the use of the instrument developed at this center to study presenile dementia or Alzheimer's disease. It has long been recognized that whole brain radiation treatment can bring about a nonspecific dementia. Coordination of PET studies and careful behavioral evaluation will elucidate this problem.

9559 **(FRCEA-TH—42) Analysis of a 3D imaging device by reconstruction from cone beam X ray radiographs.** Grangeat, P. (Ecole Nationale Superieure des Telecommunications, 75 - Paris (France); CEA Centre d'Etudes Nucleaires de Grenoble, 38 (France). Lab. d'Electronique et de Technologie de l'Informatique). Jun 1987. 213p. (In French). NTIS (US Sales Only), PC A10/MF A01. Order Number DE88751736/JAW.

The aim of our study is to analyse the principle of a 3D imaging device which attempts to restore the local density on a cuberill from a set of digital radiographs taken around the object. We have to use a ponctual radiation source to localize the acquisition lines. Therefore the attenuation measurements are modelled by the cone beam X ray transform. In the analysis of the inverse problem, we work out two inversion diagrams which compute the original function, the image of the object, by a sequence of transforms. The theoretical and algorithmical difficulty comes from the fact that, even in the simple case of a circular acquisition trajectory, the cone-shaped geometry prohibits splitting the problem into a superposition of reconstructions in two dimensions. We describe a novel theoretical framework based on the Radon transform. In this new repreaentation space, it becomes possible by a rebinning operation to redistribute the integral values associated to planes from the coordinates system linked to source positions to the spherical coordinates system of the domain. To ensure this shift of space, we have established two formulas, the first approximate but leading to faster processing, related to the Radon transform, the second exact, related to the first derivative of the Radon transform. The inversion of these transforms completes the reconstruction. We state a theorem where we present the hypothesis under which the exact diagram does restore the original function. These are not verified for a circular trajectory, owing to a shadow zone in the Radon domain associated to the planes which intersect the object but not the trajectory. We propose either to restore the missing information or to use an oscillating trajectory.

9560 **(FRNC-TH—3056) Contribution to the study of integrated system design in digital imaging. Application to digital radiology.** Boy, M. (Toulouse-3 Univ., 31 (France)). Feb 1987. 247p. (In French). NTIS (US Sales Only), PC A11/MF A01. Order Number DE88751606/JAW.

In the first part of this work, we describe the hardware and software used to design integrated systems able to acquire, memorize, process and visualize 1024 x 1024 x 8 bits images. In the second part, we present and analyse the first realised prototype system which is a digital radiology one. After a technical and economical digital radiology study, we present the angiographic and tomographic results. In the third part, we indicate possible evolution of this system and we show how the adopted structure and developed hardware allow applications in various fields.

9561 (INIS-mf—10738) **Recent progress in radiotherapy, as shown by the example of the bronchial carcinoma and the brain tumor.** Schnabel, K.; Trendelenburg, F. (Saarlaendische Krebszentrale (Tumorzentrum e.V.), Homburg/Saar (Germany, F.R.)). 1986. 87p. (In German). (CONF-8610356—). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88751012/JAW.

From Oncological training seminar of Saarlaendische Krebszentrale (Tumorzentrum); Homburg, F.R. Germany (12 Oct 1986).

Onkologie Aktuell. Schriftenreihe des Tumorzentrums Homburg/Saar.; v. 3.

This volume presents reports of selected novel radiotherapeutical methods for treatment of the bronchial carcinoma and the brain tumor, and an evaluation of first results obtained. The reports also are intended to show that advances in modern radiotherapy very much rely on basic research activities in the physical and radiobiological field, and on close cooperation between the various clinical disciplines. This is why opinions of other clinics are presented as well.

9562 (INIS-mf—11042, pp V170) **Use of the effective dose equivalent for risk assessment in biomedical radiography.** Poppitz, R. (Meditsinska Akademiya, Sofia, Bulgaria. Katedra po Rentgenologiya i Radiologiya). 1987. (In German). NTIS (US Sales Only), PC A09/MF A01. Order Number DE88780038/JAW. (CONF-870199—).

From 24. congress of the Society of Medical Radiology of the GDR; Leipzig, German D.R. (14 Jan 1987).

9563 (INIS-mf—11042, pp V172) **Estimation of volume as well as effective dose quivalents in excretion urography in children.** Menzel, B. (Staatliches Amt fuer Atomsicherheit und Strahlenschutz, Berlin, German Democratic Republic). 1987. (In German). NTIS (US Sales Only), PC A09/MF A01. Order Number DE88780038/JAW. (CONF-870199—).

From 24. congress of the Society of Medical Radiology of the GDR; Leipzig, German D.R. (14 Jan 1987).

9564 (INIS-mf—11042, pp V173) **Radiation exposure of crystalline lens and gonads in cerebral computerized tomography of infants.** Rosenkranz, G.; Tellkamp, H.; Berndt, L.; Koehler, K.; Standertskjoeld-Nordenstam, C.G. (Medizinische Akademie, Dresden, German Democratic Republic. Radiologische Klinik; Helsinki Univ., Finland). 1987. (In German). NTIS (US Sales Only), PC A09/MF A01. Order Number DE88780038/JAW. (CONF-870199—).

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9701 (INIS-mf—11048, pp 130-131) **Transmission scintigraphy - a supplementary method for diagnostics of marginaly situated liver tumours.** Chakyrov, B.N.; Chakyrov, M.A. Oct 1985. (In Bulgarian). NTIS (US Sales Only), PC A09/MF A01. Order Number DE88780035/JAW. (CONF-8510479—).

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9732 (INIS-mf—11060, pp V214) **Functional diagnostics and NMR imaging.** Schultheiss, G.K. von. (Universitaetsspital Zuerich, Switzerland. Roentgendiagnostisches Zentralinstitut). 1987. (In German). NTIS (US Sales Only), PC A07/MF A01. Order Number DE88780036/JAW. (CONF-870199—).

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9736 (INIS-mf—11060, pp vp) **Simple test phantom for quality assurance in conventional tomography.** Wolf, M. (Forschungsinstitut fuer Lungenkrankheiten und Tuberkulose, Berlin-Buch, German Democratic Republic). 1987. (In German). NTIS (US Sales Only), PC A07/MF A01. Order Number DE88780036/JAW. (CONF-870199—).

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9738 (INIS-mf—11060, pp V233) **Bone scintiscanning in children from the point of view of traumatology and orthopedics.** Fritsche, H.J.; Schneider, G. (Staedtische Klinik fuer Orthopaedie und Rehabilitation, Leipzig, German Democratic Republic; Karl-Marx-Universitaet, Leipzig, German Democratic Republic. Radiologische Klinik). 1987. (In German). NTIS (US Sales Only), PC A07/MF A01. Order Number DE88780036/JAW. (CONF-870199—).

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9741 (INIS-mf—11060, pp vp) **Microcomputer as control equipment of the afterloading device Decatron.** Spoddeck, M.; Bellstedt, K.; Jacob, R.; Kobischke, H. (Staedtisches Klinikum Berlin-Buch, German Democratic Republic). 1987. (In German). NTIS (US Sales Only), PC A07/MF A01. Order Number DE88780036/JAW. (CONF-870199—).

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9742 (INIS-mf—11060, pp vp) **Mathematical-physical determination of dose distribution around a rod-shaped /sup 192/Ir source for afterloading therapy.** Schindler, J.; Kranepuhl, H.; Schuchardt, V. (Martin-Luther-Universitaet Halle-Wittenberg, Halle, German Democratic Republic. Radiologische Klinik). 1987. (In German). NTIS (US Sales Only), PC A07/MF A01. Order Number DE88780036/JAW. (CONF-870199—).

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9743 (INIS-mf—11060, pp vp) **/sup 60/Co γ-irradiation of the bilateral system of cervical lymph nodes with opposing antero-posterior fields.** Gerlach, R.; Eichhorn, M.; Salewski, D. (Martin-Luther-Universitaet Halle-Wittenberg, Halle, German Democratic Republic. Radiologische Klinik). 1987. (In German). NTIS (US Sales Only), PC A07/MF A01. Order Number DE88780036/JAW. (CONF-870199—).

From 24. congress of the Society of Medical Radiology of the GDR; Leipzig, German D.R. (14 Jan 1987).

9744 (INIS-mf—11060, pp vp) **Studies on dose distributions in electron therapy of the thoracic wall with the linear accelerator Neptun 10 p.** Froehlich, D. (Bezirkskrankenhaus Karl-Marx-Stadt, German Democratic Republic). 1987. (In German). NTIS (US Sales Only), PC A07/MF A01. Order Number DE88780036/JAW. (CONF-870199—).

From 24. congress of the Society of Medical Radiology of the GDR; Leipzig, German D.R. (14 Jan 1987).

9745 (INIS-mf—11060, pp vp) **Optimization of radiation doses in irradiation with the linear accelerator Neptun 10 p of the cervical region using waxy moulages.** Froehlich, D.; Kaufmann, N. (Bezirkskrankenhaus Karl-Marx-Stadt, German Democratic Republic). 1987. (In German). NTIS (US Sales Only), PC A07/MF A01. Order Number DE88780036/JAW. (CONF-870199—).

From 24. congress of the Society of Medical Radiology of the GDR; Leipzig, German D.R. (14 Jan 1987).

9746 **(WHO-AFR/BRS—1) Study group on basic radiological systems. Report of the Regional Meeting, Harare, Zimbabwe, 26-31 May 1986.** (World Health Organization, Brazzaville (Congo). Regional Office for Africa). 1986. 22p. (CONF-8605311—). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88700778/JAW.

From Regional meeting on basic radiological systems; Harare, Zimbabwe (26 May 1986).

The report outlines the present status of radiation and imaging services in 13 African countries and formulates recommendations for the attention of Member States. All aspects of radiation and imaging services throughout the Region need considerable improvement. This will need careful planning to ensure the best use of available personnel and to avoid unnecessary expenditure. The current shortage of trained personnel can be met by improving existing programmes and initiating new ones within the Region; some degree of standardization would be advantageous. Cooperation throughout the Region, the enactment of radiation laws, and the help of the Regional Office for Africa and subregional offices could change the existing unsatisfactory status, which in some areas may even be described as dangerous. In this way progress could be made towards health for all by the year 2000. Also available in French. 4 tabs.

9747 **Stabilization of Z-DNA by chemical bromination and its recognition by anti-Z-DNA antibodies.** Hardin, C.C.; Zarling, D.A.; Puglisi, J.D.; Trulson, M.O.; Davis, P.W.; Tinoco, I. Jr. (Univ. of California, Berkeley). *Biochemistry;* **26**: No. 16, 5191-5199(11 Aug 1987).

Limited chemical bromination of poly[r(C-G)] (32% br^8G, 26% br^6C) results in partial modification of guanine C8 and cytosine C5, producing a mixture of A- and Z-RNA forms. The Z conformation in the brominated polynucleotide is stabilized at much lower ionic strength than in the unmodified polynucleotide. Raising the ionic strength to 6 M NaBr or $NaClO_4$ results in a transition in

Br-poly[r(C-G)] to a Z-RNA (Z/sub R/) conformation as judged by CD spectroscopy. ^1H NMR data demonstrate a 1/1 mixture of A- and Z-RNAs in 110 mM NaBr buffer at 37°C. Nuclear Overhauser effect (NOE) experiments permit complete assignments of GH8, CH6, CH5, GH1', AND CH1' resonances in both the A- and Z-forms. The NMR results indicate that unbrominated guanine residues undergo transition to the syn conformation (Z-form). Raman scattering data are consistent with a mixture of A- and Z-RNAs in 110 mM NaCl buffer at 37 °C. ^{31}P NMR spectra show six to eight resonances spread over a 1.8 ppm range whose chemical shifts are also consistent with an equilibrium mixture of A- and Z-RNAs. Radioimmunoassay and nitrocellulose filter binding competition experiments were performed to determine the extent of recognition of Br-poly[r(C-G)] by anti-Z-DNA antibodies. Competition RIA experiments verify the presence of a Z-DNA-like determinant in left-handed Br-poly[r(C-G)] at physiological NaCl concentration. In summary, these spectroscopic and immunochemical studies demonstrate that under conditions of conformational stress (i.e., containing brominated nucleosides) left-handed Z-RNA is stable and is specifically recognized by proteins at physiological temperature and ionic strength.

9748 **3-D imaging with a 3-D PET: A complete simulation of the HISPET tomograph.** Del Guerra, A.; Nelson, W.R.; Conti, M.; Porinelli, R.; Rizzo, C. (Stanford Linear Accelerator Center, Stanford, CA 94305). pp 34-41 of International workshop on physics and engineering of computerized multidimensional imaging and processing. Nalcioglu, O.; Cho, Z.H.; Budinger, T.F. Bellingham, WA; SPIE (1986). (CONF-8604213—).

From International workshop on physics and engineering of computerized multidimensional imaging and processing; Newport Beach, CA, USA (2 Apr 1986).

The authors have designed a HIgh Spatial resolution Positron Emission Tomograph with a 2π solid angle coverage, based on the use of MultiWire Proportional Chambers with dense drift space converters. The imaging capabilities of HISPET have been studied with a fully 3-D Monte Carlo simulation of the tomograph and various source/phantom configurations, By using a simple 3-D filtered back-projection algorithm a spatial resolution of 4 mm (FWHM) has been obtained. The imaging results for several radioisotope distributions are presented.

9749 **Recent developments in positron emission tomography (PET) instrumentation.** Derenzo, S.E. (Lawrence Berkeley Lab. and Donner Lab., Mail Stop 55-121, Univ. of California, Berkeley, CA 94720). pp 232-243 of International workshop on physics and engineering of computerized multidimensional imaging and processing. Nalcioglu, O.; Cho, Z.H.; Budinger, T.F. Bellingham, WA; SPIE (1986). (CONF-8604213—). Contract AC03-76SF00098.

From International workshop on physics and engineering of computerized multidimensional imaging and processing; Newport Beach, CA, USA (2 Apr 1986).

This paper presents recent detector developments and perspectives for positron emission tomography (PET) instrumentation used for medical research, as well as the physical processes in positron annihilation, photon scattering and detection, tomograph design considerations, and the potentials for new advances in detectors.

5508 Morphology

REFER ALSO TO CITATION(S) 9483, 9650

5509 Pathology

REFER ALSO TO CITATION(S) 9522

9750 (INIS-mf—11048, pp 144-145) **Application of a prostaglandin F2-alpha-radioimmunoassay for determination of the antemortem character and prescription of skin injuries.** Lazarov, I.; Frantsova, S.; Ruseva, T. Oct 1985. (In Bulgarian). NTIS (US Sales Only), PC A09/MF A01. Order Number DE88780035/JAW. (CONF-8510479—).

From 6. national congress of roentgenology, radiology and radiobiology; Sofia, Bulgaria (4 Oct 1985).

9751 **Modern statistical methods in chronic disease epidemiology: Proceedings.** Moolgavkar, S.H.; Prentice, R.L. (eds.). New York, NY; John Wiley & Sons, Inc. (1986). 283p. (DOE/ER/60283—1; CONF-8506374—). John Wiley & Sons, Inc., 605 Third Ave., New York, NY 10158-0012. Order Number TI88000380/JAW. Contract FG02-85ER60283.

From 10. conference on modern statistical methods in chronic disease epidemiology; Alta, UT, USA (24 Jun 1985).

Since the publication of Mantel and Haenszel's pioneering paper in 1959, has seen a veritable explosion of statistical methodology in chronic disease epidemiology. The central methodologic issues revolve around environmental and genetic risk assessment, and risk extrapolation. The tenth Research Application Conference held under the auspices of SIMS brought together experts from around the world to discuss the theory and applications of statistical methods in chronic disease epidemiology. This volume represents the proceedings of that conference. Relative risk regression models provide flexible and powerful tools for the analysis of epidemiologic data. These models have been the objects of intense study in the past several years, and it seems reasonable to predict that relative risk regression methods will become a, or perhaps, the, central analytical tool in chronic disease epidemiology. Thus, a major emphasis of the conference was on relative risk regression, and various papers in this volume deal with time-dependent covariates, new study designs, multivariate failure time data, methods of model criticism, parameter transformations for optimal inference, and issues in matching, covariate adjustment, and incomplete and missing covariate information.

5520 Public Health

REFER ALSO TO CITATION(S) 8955, 9751

5530 Agriculture And Food Technology

REFER ALSO TO CITATION(S) 9497, 9520, 9521, 9548, 9549, 9842

9752 **(IAEA-TECDOC—432) Guidelines for acceptance of food irradiation. Report of a task force meeting on marketing/public relations of food irradiation convened by the International Consultative Group on Food Irradiation and held in Ottawa, Canada, 15-19 September 1986.** (International Atomic Energy Agency, Vienna (Austria)). Sep 1987. 51p. (CONF-8609355—). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88700617/JAW.

From Task force meeting on marketing/public relations of food irradiation; Ottawa, Canada (15 Sep 1986).

The purpose of the meeting was to develop an action plan which can be applied in countries with varying philosophies towards food irradiation, but which would help foster a common international attitude to what is undoubtedly a controversial issue. Basic recommendations were to: Identify target groups which influence policy in regard to food irradiation; Establish a cohesive marketing strategy with flexibility to meet varied national needs; Implement an ongoing communications system designed to reach and inform decision-makers; Work in each country through an information "chain" commencing with irradiation processors; Promote to - and through - the food industry as potentially the greatest beneficiaries; Set up an administrative "Clearing House" in each country to co-ordinate promotion efforts; Assemble "Seeding Groups" who will contact and communicate with other organizations; Aim for common international branding and packaging identification for irradiated foods. 8 refs.

9753 **(INIS-mf—11035) Food irradiation: an inquiry by the Australian Consumers' Association.** (Australian Consumers' Association, Sydney). Apr 1987. 185p. NTIS (US Sales Only), PC A09/MF A01. Order Number DE88700878/JAW.

The Australian Consumers' Association's Inquiry into Food Irradiation was undertaken at the request of the Commonwealth Minister of Health, Dr N Blewett. The terms of reference of the Inquiry covered the implications of food irradiation in terms of consumer health, the environment, and the cost to the consumer.

9754 **(INIS-mf—11038) Food irradiation seminar: Asia and the Pacific.** Mitchell, G.E. (Queensland Dept. of Primary Industries, Brisbane (Australia)). 1986. 27p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88700432/JAW.

Conference and Workshop Series QC86010.

The report covers the Seminar for Asia and the Pacific on the practical application of food irradiation. The seminar assessed the practical application of food irradiation processes, commercial utilisation and international trade of irradiated food.

9755 **(INIS-mf—11039) Potential use of ionising energy treatment in Queensland's horticultural industries.** Heather, N.W.; Sheehy, P.T.; Muirhead, I.F.; Brown, B.I.; Hassall, R.N. (Queensland Dept. of Primary Industries, Brisbane (Australia)). 1985. 84p. NTIS (US Sales Only), PC A05/MF A01. Order Number DE88700433/JAW.

Information Series QI85005.

The potential application of ionising energy treatment technology in Queensland falls into three categories: insect disinfestation, disease control and quality improvement. The technology fulfils the requirements of a disinfestation treatment against Queensland fruit fly and other pests of quarantine importance in respect to efficacy, absence of phytotoxicity, absence of residues and, on technical considerations would be an ideal replacement for the fumigant EDB. The report examines the purposes of ionising energy treatment, economic and marketing aspects and research needs.

9756 (INIS-mf—11046, pp 49) **Detection and evaluation of drug induced changes in the gastrointestinal motility of beagle dogs using and indium-111-labelled resin mixed into a standard meal as tracer.** Hugo, N.; Dormehl, I.C.; Maree, M.; Van Zandwijk, C.; Pilloy, M. (Pretoria Univ., South Africa; Medical Univ. of Southern Africa, Pretoria, South Africa). 1987. NTIS (US Sales Only), PC A04/MF A01. Order Number DE88700436/JAW. (CONF-8703200—).

From 27. annual congress of the South African Association of Physicists in Medicine and Biology; Bloemfontein, South Africa (11 Mar 1987).

9757 (INIS-mf—11062, pp vp) **Effect of heat and radiation on germination and ochratoxin production of sclerotia of aspergillus ochraceus.** Paster, N.; Barkai-Golan, R.; Padova, R. (Dept. of Stored Products, ARO, Bet-Dagan, Israel; Soreq Nuclear Research Centre, Yavne, Israel). 1985. NTIS (US Sales Only), PC A08/MF A01. Order Number DE88700774/JAW. (CONF-8507166—).

From 6. international symposium on mycotoxins and phycotoxins; Pretoria, South Africa (22 Jul 1985).

9758 (INIS-mf—11062, pp S3) **Cyanoginosins - isolation, structure and biology.** Botes, D.P. (Council for Scientific and Industrial Research, Pretoria, South Africa. National Chemical Research Lab.). 1985. NTIS (US Sales Only), PC A08/MF A01. Order Number DE88700774/JAW. (CONF-8507166—).

From 6. international symposium on mycotoxins and phycotoxins; Pretoria, South Africa (22 Jul 1985).

9759 **(NIRS-RSD—75) Radioactivity survey data in Japan, number 75 December 1985.** (National Inst. of Radiological Sciences, Chiba (Japan)). 1986. 33p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88751073/JAW.

This paper provides radioactivity survey data in environmental and dietary materials as of December 1985. The concentrations of strontium-90 and cesium-137 are presented in terms of the following: total diet, rice, milk, vegetables, sea fish, freshwater fish, shellfish, and seaweeds. The samples were sent to the Japan Chemical Analysis Center from 32 contracted prefectures. The samples were prepared for radiochemical analysis. The concentrations of strontium-90 and cesium-137 in respective samples are tabulated. The maximum concentrations of strontium-90 and cesium-137 were 5.9 +- 0.42 pCi center dot p/sup -1/ center dot d/sup -1/ and 8.9 +- 0.47 pCi center dot p/sup -1/ center dot d/sup -1/, respectively, for total diet; 0.7 +- 0.19 pCi/kg and 7.4 +- 0.40 pCi/kg for rice (producing districts); 1.0 +- 0.21 pCi/kg and 8.6 +- 0.38 pCi/kg for rice (consuming districts); 8.8 +- 0.44 pCi/l and 30 +- 0.7 pCi/l for milk (producing districts for WHO program); 7.0 +- 0.41 pCi/l and 6.9 +- 0.37 pCi/l for milk (producing districts for domestic program); 2.1 +- 0.25 pCi/l and 3.8 +- 0.29 pCi/l for milk (consuming districts); 31 +- 1.3 pCi/kg and 110 +- 2 pCi/kg for powdered milk; 38 +- 0.8 pCi/kg and 9.5 +- 0.36 pCi/kg for vegetables (producing districts); 15 +- 0.5 pCi/kg and 3.2 +- 0.23 pCi/kg for vegetables (consuming districts); 1.7 +- 0.36 pCi/kg and 8.2 +- 0.39 pCi/kg for sea fish; 110 +- 2 pCi/kg and 9.2 +- 0.61 pCi/kg for freshwater fish; 0.5 +- 0.66 pCi/kg and 2.5 +- 0.55 pCi/kg for shellfish; and 5.1 +- 0.55 pCi/kg and 1.9 +- 0.30 pCi/kg for seaweeds. (Namekawa, K.).

9760 **(NIRS-RSD—77) Radioactivity survey data in Japan, number 77 June 1986.** (National Inst. of Radiological Sciences, Chiba (Japan)). 1987. 35p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88751072/JAW.

This report provides radioactivity survey data in environmental and dietary materials as of June 1986. The concentrations of strontium-90 and cesium-137 are presented in terms of the following: total diet, rice, milk, vegetables, tea, sea fish, shellfish, and seaweeds. The samples were sent to the Japan Chemical Analysis Center from 32 contracted prefectures. The samples were prepared for radiochemical analysis. The concentrations of strontium-90 and cesium-137 in respective samples are tabulated. The maximum concentrations of strontium-90 and cesium-137 were 5.0 +- 0.40 pCi/p center dot d and 15 +- 0.5 pci/p center dot d, respectively, for total diet; 0.3 +- 0.19 pCi/Kg and 2.1 +- 0.22 pci/Kg for rice (producing districts); 0.5 +- 0.18 pCi/Kg and 6.7 +- 0.30 pci/Kg for rice (consuming districts); 2.4 +- 0.26 pCi/l and 7.9 +- 0.37 pci/l for milk (producing districts for domestic program); 5.2 +- 0.35 pCi/l and 98 +- 1.2 pci/l for milk (producing districts for WHO program); 2.4 +- 0.31 pCi/l and 23 +- 0.6 pci/l for milk (consuming districts); 34 +- 1.0 pCi/Kg and 310 +- 3 pci/Kg for powdered milk; 19 +- 0.8 pCi/Kg and 2.4 +- 0.21 pci/Kg for vegetables (producing districts); 3.9 +- 0.41 pCi/Kg and 1.5 +- 0.21 pci/Kg for vegetables (consuming districts); 150 +- 5 pCi/Kg and 4100 +- 21 pci/Kg for Japanese tea; 0.7 +- 0.26 pCi/Kg and 19 +- 0.6 pci/Kg for sea fish; 0.0 +- 1.5 pCi/Kg and 8.7 +- 0.76 pci/Kg for shellfish; and 1.3 +- 0.32 pCi/Kg and 8.5 +- 0.41 pci/Kg for seaweeds. (Namekawa, K.).

56 BIOMEDICAL SCIENCES, APPLIED STUDIES

5601 Radiation Effects

REFER ALSO TO CITATION(S) 9527, 9528, 9529, 9530, 9533, 9538

9761 **(CEA-DPS—86-10-SEAPS) Dosimetry near the cobalt 60 source situated in the exposure room of Bruyeres le Chatel, service of experimental toxicology and cancerology.** Kerlau, G.; Le Grand, J.; Roux, Y. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. de Protection Sanitaire). 1986. 13p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88751723/JAW.

The dosimetry near the Cobalt source situated in the exposure room of Bruyeres le Chatel has been made during a measurement campaign, and completed by calculations using Monte Carlo method. The measurements have been made with thermoluminescent Panasonic Dosemeters. Three steps have been considered: - homogeneity in the room, - dose at the experimental table level, - dose at the rat cage level. The Kerma rates have been calculated as well as the energy spectra and the direction distribution of the photons.

9762 **(CEA-DPS—87-02-SHR) Early diagnosis and monitoring of whole-body accidental exposure.** Flury-Herard, A.; Jullien, D. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. de Protection Sanitaire). 1987. 26p. (In French). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88751724/JAW.

This paper deals with the handling of accidental, acute or protracted, whole-body overexposures. It is complementary to the report DPS 86/07 SEAPS previously published. The criteria for initial classification, as a function of the mean absorbed dose, the clinical and paraclinical evaluation, the monitoring methods and the treatments to undertake are described successively. The basic components of the therapy are the intensive care of the hematological syndrome with blood products transfusions and anti-infection prophylaxy. The indications and conditions for bone-marrow grafts are also discussed.

9763 **(CONF-861123—9) A mathematical model of the nine-month pregnant woman for calculating specific absorbed fractions.** Watson, E.E.; Stabin, M.G. (Oak Ridge Associated Universities, Inc., TN (USA)). 1986. Contract AC05-76OR00033. 8p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88001307/JAW.

From CEC/CEA international workshop on age-related factors in radionuclide metabolism and dosimetry; Angers, France (26 Nov 1986).

Existing models that allow calculation of internal doses from radionuclide intakes by both men and women are based on a mathematical model of Reference Man. No attempt has been made to allow for the changing geometric relationships that occur during pregnancy which would affect the doses to the mother's organs and to the fetus. As pregnancy progresses, many of the mother's abdominal organs are repositioned, and their shapes may be somewhat changed. Estimation of specific absorbed fractions requires that existing mathematical models be modified to accommodate these changes. Specific absorbed fractions for Reference Woman at three, six, and nine months of pregnancy should be sufficient for estimating the doses to the pregnant woman and the fetus. This report describes a model for the pregnant woman at nine months. An enlarged uterus was incorporated into a model for Reference Woman. Several abdominal organs as well as the exterior of the trunk were modified to accommodate the new uterus. This model will allow calculation of specific absorbed fractions for the fetus from photon emitters in maternal organs. Specific absorbed fractions for the repositioned maternal organs from other organs can also be calculated. 14 refs., 2 figs.

9764 **(DOE/OR/00033—T363) Studies on radiation-induced chromosome damage in humans: Semi-annual progress report, October 1, 1986-March 31, 1987.** Littlefield, L.G. (Oak Ridge Associated Universities, Inc., TN (USA)). 31 Mar 1987. Contract AC05-76OR00033. 29p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88002400/JAW.

This report summarizes recent research to determine and report the frequency of somatic cell chromosome aberrations in approximately 200 lymphocyte metaphases from each of 200 control patients or persons who received radiation for enlarged thymus, and from an additional 475 irradiated and control subjects selected by NCI from populations exposed to therapeutic ionizing radiation during the period 1930 to 1970. The priority of populations to be studied will be determined by NCI in consultation with the contractor and with advice from NCI consultants. Additional research will determine and report dose response curves among the several populations, to determine how differences with respect to radiation dose, quality of radiation, fractionation, sex and age within and among groups affect the "dose-response relationship." 7 tabs.

9765 (IAEA-RL—147, pp 28-36) **Short summary of the activities in Italy after the Chernobyl nuclear accident.** Ingrao, G. Jul 1987. NTIS (US Sales Only), PC A05/MF A01. Order Number DE88700361/JAW. (CONF-8609348—).

From Consultants' meeting on the determination of radionuclides in grass ecosystem samples; Vienna, Austria (23 Sep 1986).

A summary of the measurements carried out in Italy is presented. The following items were monitored: air, fallout, rate of exposure, soil, grass, vegetables, fodder, milk, cheese, eggs, meat and fish. The data have been transferred to a data bank, containing now the information on more than 100,000 measurements. 6 figs, 1 tab.

9766 **(INIS-BR—888) Uranium and tritium determination in workers urine.** Passarelli, M.M. (Sao Paulo Univ. (Brazil)). 1977. 84p. (In Portuguese). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88700422/JAW.

Fluorimetry technique for uranium analysis and liquid scintillation method for tritium determination to determine uranium and tritium in workers urine was used. (L.M.J.).

9767 **(INIS-BR—889) Biochemical aspects of the immunomodular action in irradiated survival mice with /sup 60/C gama irradiation.** Garcia Agudo, N.L.delM. de. (Sao Paulo Univ. (Brazil). Inst. de Quimica). 1983. 82p. (In Portuguese). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88700423/JAW.

The radioprotective action of Calmetti-Guerin bacillus (BCG), Corynebacterium parvum, Escherichia coli Lipopolysaccharides (LPS) and peptone proteose was evaluated. A single injection of the macrophage activating agents prior to /sup 60/Co whole-body irradiation increased the survival rate of mice in the lethal dose range. (L.M.J.).

9768 **(INIS-GB—12) Effects and control of radiation.** Saunders, P.A.H. (UKAEA Headquarters, London). Sep 1985. 24p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88750772/JAW.

New edition based on the sievert unit of radiation.

Written for the layman, this booklet describes the effects of ionising radiation on people, and discusses the somatic hereditary risk estimates, and the measures taken to ensure the safe operation of the nuclear industry. New edition based on the sievert. (U.K.).

9769 **(INIS-mf—10772) Gel chromatographic investigations for the radiolysis of cattle serum albumin and desoxyribonucleic acid.** Leithner, L.H. (Erlangen-Nuernberg Univ., Erlangen (Germany, F.R.). Medizinische Fakultaet). 28 Mar 1983. 99p. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88751503/JAW.

Aqueous solutions of RSa, DNA and solutions which contained both substances were irradiated under N/sub 2/, O/sub 2/ and N/sub 2/O. The products of radiolysis were examined by gel chromatography, where after treatment with sodium dodecyl sulphate and mercapto-ethanol, the proportion of non-covalent combinations and of disulphide groups was determined. If one irradiates RSA solutions under N/sub 2/ and N/sub 2/O, the yield of aggregate and the molecular size of the particles in the aggregate rise with the dose of radiation, until at the maximum dose of 1714 Gy, all RSA molecules are aggregated by covalent combination. Dimers are first formed under N/sub 2/, and dimers and trimers are formed under N/sub 2/O. The radiolysis of RSA under O/sub 2/ leads to the formation of protein fractions. When DNA solutions are irradiated with a dose of 857 Gy, then regardless of the existing gas condition, only DNA fractions are formed. The irradiation of sample solutions, which contain both RSA and DNA, shows that combinations of protein and nucleic acid only occur under N/sub 2/ and N/sub 2/O, but not under O/sub 2/. The decomposition of DNA under N/sub 2/ is largely prevented in the presence of protein, while under N/sub 2/O DNA is decomposed. Although the cross linkages between the DNA and the RSA were missing, irradiation under O/sub 2/ in the presence of protein only led to partial decomposition of DNA, as the primary radicals of the water were collected by the protein.

9770 **(INIS-mf—10784) Experiments on the learning ability of rats after a low dose-rate γ-irradation at various days of gestation.** Seitz, B. (Muenchen Univ. (Germany, F.R.). Fachbereich Tiermedizin). 25 Jul 1986. 95p. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88751515/JAW.

Pregnant Wistar rats were irradiated at days 11, 13 or 16 of gestation with 0.60 Gy of /sup 60/Co-gamma-radiation at a dose-rate of 0.01 Gy/min. Controls were sham-irradiated and tested si-

multaneously. The adult female offspring was confronted with a set of standardized operant conditioning test sessions. Food reinforcement was made contingent to the fulfillment of gradually increased learning demand. The tests were micro-computer-controlled and the data stored on flexibe disks. Performance deficits were found in the groups (N=10) irradiated at gestational days 11 or 16 with respect to the controls. The pattern of operant test performance showed a circadian rhythm in all groups but was unaffected by irradiation. The observed performance differences between groups irradiated with the same dose but different dose-rate did not reach statistical significant levels. Motor coordination and strength were also tested in juvenile male littermates. In these tests the prenatally irradiated animals performed significantly poorer than the controls.

9771 (INIS-mf—11042, pp V5) **Cytotoxicity and radiosensitizing effect of some 4-nitroimidazole derivatives.** Schroeder, E.; Morgenstern, J.; Schubert, G.; Merkle, K. (Akademie der Wissenschaften der DDR, Berlin. Zentralinstitut fuer Krebsforschung; VEB Saechsisches Serumwerk, Dresden, German Democratic Republic). 1987. (In German). NTIS (US Sales Only), PC A09/MF A01. Order Number DE88780038/JAW. (CONF-870199—).

From 24. congress of the Society of Medical Radiology of the GDR; Leipzig, German D.R. (14 Jan 1987).

9772 (INIS-mf—11042, pp V6) **Animal experiments on the response modifying effect of meclofenoxate.** Hamann, D.; Bienengraeber, V.; Werner, H. (Rostock Univ., German Democratic Republic. Radiologische Klinik). 1987. (In German). NTIS (US Sales Only), PC A09/MF A01. Order Number DE88780038/JAW. (CONF-870199—).

From 24. congress of the Society of Medical Radiology of the GDR; Leipzig, German D.R. (14 Jan 1987).

9773 (INIS-mf—11042, pp V8) **Studies on the radiosensitizing effect of hyperthermia on the piglet lung.** Schorcht, J.; Herrmann, T.; Knorr, A.; Dauterstedt, W. (Medizinische Akademie, Dresden, German Democratic Republic. Radiologische Klinik; Forschungsinstitut Manfred von Ardenne, Dresden, German Democratic Republic). 1987. (In German). NTIS (US Sales Only), PC A09/MF A01. Order Number DE88780038/JAW. (CONF-870199—).

From 24. congress of the Society of Medical Radiology of the GDR; Leipzig, German D.R. (14 Jan 1987).

9774 (INIS-mf—11042, pp V9) **Modification of hematological reactions after whole-body irradiation of piglets by sublethal pre-irradiation.** Koch, F.; Kamprad, F.; Melzer, R. (Karl-Marx-Universitaet, Leipzig, German Democratic Republic. Sektion Tierproduktion und Veterinaermedizin; Karl-Marx-Universitaet, Leipzig, German Democratic Republic. Radiologische Klinik). 1987. (In German). NTIS (US Sales Only), PC A09/MF A01. Order Number DE88780038/JAW. (CONF-870199—).

From 24. congress of the Society of Medical Radiology of the GDR; Leipzig, German D.R. (14 Jan 1987).

9775 (INIS-mf—11042, pp V20) **Radiogenic developmental disturbances evidenced by animal experiments using small radiation doses.** Michel, C. (Zurich Univ., Switzerland). 1987. (In German). NTIS (US Sales Only), PC A09/MF A01. Order Number DE88780038/JAW. (CONF-870199—).

From 24. congress of the Society of Medical Radiology of the GDR; Leipzig, German D.R. (14 Jan 1987).

9776 (INIS-mf—11042, pp V81) **Pharmacokinetics and pharmacodynamics influenced by ionizing radiations.** Thiel, J.; Boehme, H.R. (Karl-Marx-Universitaet, Leipzig, German Democratic Republic). 1987. (In German). NTIS (US Sales Only), PC A09/MF A01. Order Number DE88780038/JAW. (CONF-870199—).

From 24. congress of the Society of Medical Radiology of the GDR; Leipzig, German D.R. (14 Jan 1987).

9777 (INIS-mf—11042, pp V87) **Testicular radiosensitivity of fetal mice against cumulative dose from tritium.** Dev, P.K. (Rajasthan Univ., Jaipur, India. Radiation Biology Lab.). 1987. NTIS (US Sales Only), PC A09/MF A01. Order Number DE88780038/JAW. (CONF-870199—).

From 24. congress of the Society of Medical Radiology of the GDR; Leipzig, German D.R. (14 Jan 1987).

9778 (INIS-mf—11042, pp V90) **Experimental studies on the radiosensitivity of rat rectum and ureter.** Trott, K.R. (Saint Bartholomew's Hospital, London, UK). 1987. (In German). NTIS (US Sales Only), PC A09/MF A01. Order Number DE88780038/JAW. (CONF-870199—).

From 24. congress of the Society of Medical Radiology of the GDR; Leipzig, German D.R. (14 Jan 1987).

9779 (INIS-mf—11042, pp V92) **Radiation effects in heart, liver, kidneys and pancreas of piglets as determined by blood serum investigations.** Knorr, A.; Herrmann, T.; Voigtmann, L.; Lorenz, J.; Bergmann, S. (Medizinische Akademie, Dresden, German Democratic Republic). 1987. (In German). NTIS (US Sales Only), PC A09/MF A01. Order Number DE88780038/JAW. (CONF-870199—).

From 24. congress of the Society of Medical Radiology of the GDR; Leipzig, German D.R. (14 Jan 1987).

9780 (INIS-mf—11042, pp V3) **Clinical use of radiosensitizers.** Merkle, K.; Oehler, W.; Schroeder, E. (Akademie der Wissenschaften der DDR, Berlin. Zentralinstitut fuer Krebsforschung). 1987. (In German). NTIS (US Sales Only), PC A09/MF A01. Order Number DE88780038/JAW. (CONF-870199—).

From 24. congress of the Society of Medical Radiology of the GDR; Leipzig, German D.R. (14 Jan 1987).

9781 (INIS-mf—11042, pp V4) **Metronidazole in radiation therapy of radioresistent subgroups of cervix cancer.** Balmukhanov, S.B.; Rismohamedova, R.S.; Mussapirova, N.A.; Aitkulova, Z.; Abdrahmanov, J.N. (Kazakhskij Nauchno-Issledovatel'skij Inst. Onkologii i Radiologii, Alma-Ata, USSR). 1987. NTIS (US Sales Only), PC A09/MF A01. Order Number DE88780038/JAW. (CONF-870199—).

From 24. congress of the Society of Medical Radiology of the GDR; Leipzig, German D.R. (14 Jan 1987).

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9836 (INIS-mf—11048, pp 187) **Decontamination effects at combined injuries.** Kiradzhiev, G.; Lalova, Kh. (Meditsinska Akademiya, Sofia, Bulgaria. Nauchen Inst. po Rentgenologiya i Radiobiologiya). Oct 1985. (In Bulgarian). NTIS (US Sales Only), PC A09/MF A01. Order Number DE88780035/JAW. (CONF-8510479—).

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9837 (INIS-mf—11048, pp 187-188) **Toxic effects of pentasin at combined radiation injuries.** Kiradzhiev, G.; Lalova, Kh.; Slavov, S.; Petkov, T. (Meditsinska Akademiya, Sofia, Bulgaria. Nauchen Inst. po Rentgenologiya i Radiobiologiya). Oct 1985. (In Bulgarian). NTIS (US Sales Only), PC A09/MF A01. Order Number DE88780035/JAW. (CONF-8510479—).

From 6. national congress of roentgenology, radiology and radiobiology; Sofia, Bulgaria (4 Oct 1985).

9838 (INIS-mf—11048, pp 189) **Quantitative criteria for skin deactivation means.** Simova, G.; Shopov, N.; Boyadzhiev, A. (Meditsinska Akademiya, Sofia, Bulgaria. Nauchen Inst. po Rentgenologiya i Radiobiologiya). Oct 1985. (In Bulgarian). NTIS (US Sales Only), PC A09/MF A01. Order Number DE88780035/JAW. (CONF-8510479—).

From 6. national congress of roentgenology, radiology and radiobiology; Sofia, Bulgaria (4 Oct 1985).

9839 (INIS-mf—11048, pp 34) **Angiographic criteria for anatomic changes determination at children with fallout tetralogy and interventricular defect with secondary pulmonal stenosis.** Evtimova, N.; Slavkov, N.; Vojvodov, A.; Ninova, P. Oct 1985. (In Bulgarian). NTIS (US Sales Only), PC A09/MF A01. Order Number DE88780035/JAW. (CONF-8510479—).

From 6. national congress of roentgenology, radiology and radiobiology; Sofia, Bulgaria (4 Oct 1985).

9840 (INIS-mf—11048, pp 179) **Radiation protection evaluation of waste products from power engineering and their possible utilisation in construction.** Petrov, T.; Badulin, V. (Meditsinska Akademiya, Sofia, Bulgaria. Nauchen Inst. po Rentgenologiya i Radiobiologiya). Oct 1985. (In Bulgarian). NTIS (US Sales Only), PC A09/MF A01. Order Number DE88780035/JAW. (CONF-8510479—).

From 6. national congress of roentgenology, radiology and radiobiology; Sofia, Bulgaria (4 Oct 1985).

9841 (INIS-mf—11060, pp vp) **Effects of UV radiation on absorption spectrophotometric properties of Eagle's culture medium.** Bollmann, G.; Redmann, K. (Medizinische Akademie, Dresden, German Democratic Republic. Radiologische Klinik). 1987. (In German). NTIS (US Sales Only), PC A07/MF A01. Order Number DE88780036/JAW. (CONF-870199—).

From 24. congress of the Society of Medical Radiology of the GDR; Leipzig, German D.R. (14 Jan 1987).

9842 (INIS-mf—11060, pp vp) **Radiation effects on tubers of the genera Freesia and Gladiolus.** Koller, B.; Schmidt, W.; Nadrowitz, R.; Richter, P. (GPG 'Klaus Stoertebeker', Stralsund, German Democratic Republic; Ernst-Moritz-Arndt-Universitaet, Greifswald, German Democratic Republic. Radiologische Klinik; Humboldt-Universitaet, Berlin, German Democratic Republic). 1987. (In German). NTIS (US Sales Only), PC A07/MF A01. Order Number DE88780036/JAW. (CONF-870199—).

From 24. congress of the Society of Medical Radiology of the GDR; Leipzig, German D.R. (14 Jan 1987).

9843 (INIS-mf—11060, pp V256) **Radiation effects of the spine of infants after radiotherapy of Wilms' tumor.** Willich, E.; Pfeil, G.; Niethard, F.U.; Scheibel, P. (Heidelberg Univ., Germany, F.R. Orthopaedische Klinik und Poliklinik). 1987. (In German). NTIS (US Sales Only), PC A07/MF A01. Order Number DE88780036/JAW. (CONF-870199—).

From 24. congress of the Society of Medical Radiology of the GDR; Leipzig, German D.R. (14 Jan 1987).

9844 (INIS-mf—11060, pp V257) **Late radiation effects of the skeleton after abdominal irradiation in children.** Schorcht, J.; Geyer, P.; Voigtmann, L.; Beer, L.; Roenisch, P.S.; Rupprecht, E. (Medizinische Akademie, Dresden, German Democratic Republic. Radiologische Klinik; Medizinische Akademie, Dresden, German Democratic Republic; Medizinische Akademie, Dresden, German Democratic Republic. Kinderklinik). 1987. (In German). NTIS (US Sales Only), PC A07/MF A01. Order Number DE88780036/JAW. (CONF-870199—).

From 24. congress of the Society of Medical Radiology of the GDR; Leipzig, German D.R. (14 Jan 1987).

9845 (INIS-mf—11060, pp V258) **Alterations of skeleton and muscles after curative radiotherapy of malignant tumors in children.** Kamprad, F.; Hoermann, D.; Willnow, U.; Kloeppel, R. (Karl-Marx-Universitaet, Leipzig, German Democratic Republic. Radiologische Klinik). 1987. (In German). NTIS (US Sales Only), PC A07/MF A01. Order Number DE88780036/JAW. (CONF-870199—).

From 24. congress of the Society of Medical Radiology of the GDR; Leipzig, German D.R. (14 Jan 1987).

9846 **(INIS-mf—11060) 24. Congress of the Society of Medical Radiology of the GDR with international participation. Part 2. Abstracts.** (Gesellschaft fuer Medizinische Radiologie (German Democratic Republic); Gesellschaft fuer Paediatrie, Berlin (German Democratic Rpublic)). 1987. vp. (In German). (CONF-870199—). NTIS (US Sales Only), PC A07/MF A01. Order Number DE88780036/JAW.

From 24. congress of the Society of Medical Radiology of the GDR; Leipzig, German D.R. (14 Jan 1987).

Items within the scope of EDB have been entered individually into the data base. (ACR)

9847 **(IPNO-DRE—87-02) Impact of the changes from I.C.R.P.-26 to I.C.R.P.-48 recommendations on the potential radiotoxicity of the discharged LWR, FBR and CANDU fuels.** Elayi, A.G.; Schapira, J.P. (Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire). 1987. 21p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88751738/JAW.

In order to take into account new metabolic data, the International Commission for Radiological Protection (I.C.R.P.) had to regularly update the recommended values used for radiotoxicity definition and calculation. In the present work we compare the fuel radiotoxicity from different reactors and we study the impact of the changes in the I.C.R.P. recommendations on these radiotoxicities.

9848 **(IPNO-DRE—87-07) Long-term radiotoxicity, in the framework of the ICRP-48, of high level wastes and spent fuels produced by light water reactors: impact of burn-up extension and of the use of mixed oxide fuels.** Elayi, A.G.; Schapira, J.P. (Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire). 1987. 37p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88751739/JAW.

The time evolution of radiotoxicities of spent fuels and high-level wastes have been calculated up to 10/sup 7/ years, in the framework of the recent I.C.R.P.-48 guideline, in which the ratio dose/ingested-activity has been divided by 10 for Np, multiplied by 10 for Pu and by 2 for Am, Cm and Cf, with respect to the previous I.C.R.P.-30 values. In the case of burn-up extension of the standard 33,000 MWd/t enriched uranium fuel, and in the case of plutonium recycle in light-water reactors, one shows that the spent fuel radiotoxicity is now dominated by its plutonium content, most of the time up to about 10/sup 5/ years. Possible incineration effects are discussed within these two fuel cycle options.

9849 **(ISH—100) Radiation effects - radiation hazards - radiation protection. Main fields of work of the ISH (Institute of Radiation Hygiene).** Kaul, A. (ed.). (Bundesgesundheitsamt, Neuherberg (Germany, F.R.). Inst. fuer Strahlenhygiene). Sep 1986. 93p. (In German). Bundesgesundheitsamt, Neuherberg, Germany, F.R. Inst. fuer Strahlenhygiene.

Since 1975, the scientific discipline 'radiation hygiene' has its own institute within the BGA (Federal Health Office). The main fields of work of this institute, the ISH, have been defined along the line of the BGA tasks, which in general are to enhance public health, reduce environmental hazards, and prevent disease, and the three main fields of activity of the ISH have been defined to cover radiation effects, radiation hazards, and radiation protection. The ISH pursues basic and applied research which frequently is combined with administrative goals. Results of work in selected subject fields have been compiled in 1986 in the Official Health Bulletin (Bundesgesundheitsblatt) as a survey presented on the occasion of the 25th anniversary of the foundation of the BGA's Department for Radiation Exposure. The present one-hundredth issue of the ISH publication series contains an overview over the work accomplished and results published in original papers.

9850 **(JINR-R—19-86-853) Effect of neutron irradiation on the callus tissue growth of Ruta graveolens and on the rutacridon content.** Gatsek, Eh.; Ismailova, Eh.N.; Nazarov, V.M.; Kuzovkina, I.N.; Shirinskaya, M.G. (Joint Inst. for Nuclear Research, Dubna, USSR. Lab. of Neutron Physics; AN SSSR, Moscow. Inst. Fiziologii Rastenij). (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Neutron Physics). 1986. 6p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88700932/JAW.

The paper present data on radiosensitivity of two stems R-20 and R-15 of Ruta graveolens (differing in their biosynthetic activity) manifested in the change of growth rate, rutacridon concentration and "yield" of rutacridon alcaloid. The results are discussed of tissue irradiated performed at IBR-2 biophysical complex (Regata installation) under various dose powers in the pulse (from 10 Gr/s to 1x10/sup 4/ Gr/s) in the dose range from 0.3 to 400 Gr. It is observed that neutron irradiation stimulates Ruta graveolens cell growth, increase the "yield" of rutacridon alcoloid under stimulating doses from 0.3 to 5.0 Gr in the first passage after irradiation. The stem R-15 reveals a higher radiosensitivity than the stem-producent. From the results obtained with Regata installation one may see that the rutacridon concentration increases with increasing doses. Cell growth suppression is observed in the second passage after irradiation both under small and greater doses. 11 refs.; 4 figs.

9851 **(LBL-PUB—268) Fifty years of progress, 1937-1987.** Budinger, T.F. (ed.). (California Univ., Berkeley (USA). Donner Lab.). 1987. Contract AC03-76SF00098. 62p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE88001404/JAW.

This booklet was prepared for the 50th anniversary of medical and biological research at the Donner Laboratory and the Lawrence Berkeley Laboratory of the University of California. The intent is to present historical facts and to highlight important facets of fifty years of accomplishments in medical and biological sciences. A list of selected scientific publications from 1937 to 1960 is included to demonstrate the character and lasting importance of early pioneering work. The organizational concept is to show the research themes starting with the history, then discoveries of medically important radionuclides, then the use of accelerated charged particles in therapy, next human physiology studies then sequentially studies of biology from tissues to macromolecules; and finally studies of the genetic code. 83 figs.

9852 (NRPB-R—171-Add.) **Risks of leukaemia and other cancers in Seascale from radiation exposure. Addendum to Report R171.** Stather, J.W.; Dionian, J.; Brown, J.; Fell, T.P.; Muirhead, C.R. (National Radiological Protection Board, Chilton (UK)). Apr 1986. 164p. NTIS (US Sales Only), PC A08/MF A01. Order Number DE88750804/JAW.

Available from H.M. Stationery Office, Price Pound 9.00.

Including new data in the radiation dose calculations for the Seascale study population of 1225 children and young persons, followed to 20 years of age or 1980, has, with modifications to dosimetric models, increased the predicted number of radiation-induced leukaemia resulting from Sallafield discharges from 0.01 to 0.016. Risk to the average child in the study, from the discharges, is now calculated as about 1 in 75,000 with a maximum risk of about 1 in 30,000 for children born in the mid-1950s. For the four fatal leukemias to be attributed to the Sellafield operations, the calculated average risk for all the children would have to be increased about 250 times. Estimate of the overall risk of radiation-induced leukaemia in the study population, from combined sources, has increased by less than 10% of the previous estimate and the total number of cases is still rounded to 0.1, as in R171. Risk to the average child is now calculated as about 1 in 12,250, about two thirds from natural background, 16% from Sellafield discharges, and 9% each from weapons fallout and medical exposure. (U.K.).

9853 (PNL-SA—14043) **Proceedings of the Department of Energy workshop on radiobioassay and internal dosimetry.** (Pacific Northwest Lab., Richland, WA (USA)). Mar 1987. Contract AC06-76RL01830. 414p. (CONF-860146—). NTIS, PC A18/MF A01; 1; GPO Dep. Order Number DE87014697/JAW.

From Radiobioassay and internal dosimetry workshop; Albuquerque, NM, USA (20 Jan 1986).

Individual papers from this workshop are processed separately for the Energy Data Bases. Topics include the application of radiobioassay to the problems of determining radiation exposure from internal sources, discussions of the effects of current and future regulations on the role of the health physicist, and the design and use of phantoms. (TEM)

9854 (PNL-SA—14043, pp 5-17) **Foibles of internal dosimetry systems.** Healy, J.W. Mar 1987. NTIS, MF18/MF A01. Order Number DE87014697/JAW. (CONF-860146—).

From Radiobioassay and internal dosimetry workshop; Albuquerque, NM, USA (20 Jan 1986).

Any system of internal dosimetry intended for widespread use must provide a series of assumptions, and models of calculation. These models will depend upon the basic limitations of dose, risk, or quantity of material that the system is designed to meet. The quirks in most systems arise at this point, depending upon the desires of the designers to provide a workable system that provides safety and depends on the proper use of the models chosen to implement the system. This paper presents illustrations of some of the quirks, or foibles in the past and the current system and discusses a few of the options open for the future. 16 figs.

9855 (PNL-SA—14043, pp 19-29) **Internal dosimetry upgrade program.** Heid, K.R.; Traub, R.J. Mar 1987. NTIS, MF18/MF A01. Order Number DE87014697/JAW. (CONF-860146—).

From Radiobioassay and internal dosimetry workshop; Albuquerque, NM, USA (20 Jan 1986).

This report describes a program to evaluate and upgrade internal dosimetry capabilities at DOE and DOE contractor facilities. This is a multi-laboratory, long range effort that will upgrade internal dosimetry programs at DOE facilities and will be interfaced closely with other DOE-sponsored programs such as the various animal radiobiological studies, the plutonium and uranium registries, and other available research data. 2 refs.

9856 (PNL-SA—14043, pp 33-39) **Impact of standards on current dosimetry practices.** Vallario, E.J. (Department of Energy, Washington, DC). Mar 1987. NTIS, MF18/MF A01. Order Number DE87014697/JAW. (CONF-860146—).

From Radiobioassay and internal dosimetry workshop; Albuquerque, NM, USA (20 Jan 1986).

One of the major driving forces behind the initiative to upgrade measurement technology comes from changes in radiation protection standards. The interrelationship between measurement technology and standards is essential to understanding the nature of the impact and changes. From a broad perspective, the adjustment of the dose conversion factor, usually referred to as quality factor (Q) for neutrons, will impact on the sensitivity of neutron dosimetry. If the Q is increased by a factor of two, the current minimum detectable level will go from 50 to 100 millirads. A similar impact may be observed from the International Commission on Radiological Protection (ICRP) change in internal dosimetry, i.e., going from a critical organ concept to an effective dose-equivalent along with the use of a committed-dose system. These impacts will require a refocusing on the entire system of internal dose assessment.

9857 (PNL-SA—14043, pp 41-51) **National Council on Radiation Protection and Standards (NCRP) report 84.** Stannard, J.N. Mar 1987. NTIS, MF18/MF A01. Order Number DE87014697/JAW. (CONF-860146—).

From Radiobioassay and internal dosimetry workshop; Albuquerque, NM, USA (20 Jan 1986).

The National Council on Radiation Protection and Measurements (NCRP) Report 84 (1985) was prepared by Scientific Committee-57 (SC-57) whose mission is internal emitter standards. The committee was organized as a mixture of a steering committee to manage the work of several Task Groups, now numbering 15 and a committee to write reports on broad problems in the development of standards for radionuclide exposures. Emphasis is currently on occupational exposure, but eventually will embrace population and environmental exposures in collaboration with the environmentally oriented committees of NCRP. This report describes the initial phase of work involving broad problems of internally deposited radionuclides. 5 refs., 2 tabs.

9858 (PNL-SA—14043, pp 53-72) **Modeling the deposition and clearance of inhaled particles deposited in the respiratory tract of people.** Cuddihy, R.G. (Lovelace Inhalation Toxicology Institute, Albuquerque, NM). Mar 1987. NTIS, MF18/MF A01. Order Number DE87014697/JAW. (CONF-860146—).

From Radiobioassay and internal dosimetry workshop; Albuquerque, NM, USA (20 Jan 1986).

New respiratory tract dosimetry models for inhaled radioactive aerosols are being developed by a task group of the National Council on Radiation Protection and Measurements (NCRP) to provide general methods for calculating radiation doses to the nasal airway epithelium, bronchial epithelium, and pulmonary region of the lung, and thoracic lymph nodes. These calculations apply to people of different body size, health status, and smoking habits. In contrast to the current ICRP dosimetry models that are used to develop exposure control guidelines for radiation workers, the model described here represents the morphometry of the respiratory tract using a mathematical model, variations in airway dimensions with body size, clearance in nasal and bronchial airways in terms of a continuous mucus flow with competing absorption into the blood, clearance in the pulmonary region using time varying mechanical transfer and absorption rate functions, and thoracic lymph nodes separate from the pulmonary region with uptake and clearance rates derived from experimental studies. 41 refs., 2 figs., 3 tabs.

9859 (PNL-SA—14043, pp 73-82) **Review of the probability of causation tables.** Traub, R.J. Mar 1987. NTIS, MF18/MF A01. Order Number DE87014697/JAW. (CONF-860146—).

From Radiobioassay and internal dosimetry workshop; Albuquerque, NM, USA (20 Jan 1986).

Probability of causation refers to a statistical method to determine whether an individual's cancer was caused by a previous exposure to radiation. Other terms are "attributable risk" and "assigned share." The probability of causation tables that are discussed are those described in a report entitled Report of the National Institutes of Health ad hoc Working Group to Develop Radioepidemiological Tables (NIH 1985). This report describes a compensation scheme that would increase the compensation to cancer victims based upon the probability that their cancer was caused by radiation exposures. 2 refs., 6 tabs.

9860 (PNL-SA—14043, pp 83-98) **Radiation Litigation and Internal Dosimetry.** Jose, D.E. (Pepper, Hamilton, and Scheetz, Philadelphia, PA). Mar 1987. NTIS, PC A18/MF A01. Order Number DE87014697/JAW. (CONF-860146—).

From Radiobioassay and internal dosimetry workshop; Albuquerque, NM, USA (20 Jan 1986).

Radiation Litigation refers to those lawsuits filed by individuals who claim to have been injured by some past exposure to ionizing radiation. Law classifies these cases as personal injury or tort cases. However, they are a new breed of such cases and the law is presently struggling with whether these cases can be resolved using the traditional methods of legal analysis or whether new forms of analysis, such as probability of causation, need to be applied. There are no absolutely certain rules concerning how these particular lawsuits will be tried and analyzed. The United States presently is defending cases filed by approximately 7000 plaintiffs. The private nuclear industry is defending cases filed by over 2000 plaintiffs. While not all of these cases will actually be tried on their merits, at least some will and internal dosimetry will play a very important part in many of these trials.

9861 (PNL-SA—14043, pp 99-104) **Internal dosimetry for epidemiologic studies.** Groer, P.G. (Oak Ridge Associated Universities, TN). Mar 1987. NTIS, PC A18/MF A01. Order Number DE87014697/JAW. (CONF-860146—).

From Radiobioassay and internal dosimetry workshop; Albuquerque, NM, USA (20 Jan 1986).

In traditional epidemiologic analyses, a single valued summary index, the standardized mortality ratio (SMR), is quite popular. The SMR is simply the ratio of the number of deaths observed in the study population to the number of deaths expected if the study population were subject to the age-specific rates of a standard population. SMRs for all causes or specific causes can be calculated. For such a simple analysis an exposed cohort is often characterized by an average organ or whole body dose or dose interval, and the necessary dose estimation effort is relatively minor. Modern statistical methods focus on the estimation of the cause-specific mortality rate λ for study populations exposed to ionizing radiations or toxic chemicals. The dependence of λ on factors other than demographic characteristics, such as race and sex, is usually described through a parametric model. Such factors, often called covariates or covariables, are incorporated in the mathematical expression for the hazard rate. The external gamma dose or the internal lung dose from inhaled uranium are good examples for covariates. This type of analysis permits the use of individual doses and gives a detailed and quantitative description of the mortality rate as a function of the covariables, but at the cost of a major dosimetric effort. The generation of the necessary dose information and also the calculational efforts become especially taxing for time-dependent covariates such as an internal, cumulative organ dose. 4 refs.

9862 (PNL-SA—14043, pp 107-123) **Some further PUQFUA studies.** Lawrence, J.N.P. (Los Alamos National Lab., NM). Mar 1987. NTIS, PC A18/MF A01. Order Number DE87014697/JAW. (CONF-860146—).

From Radiobioassay and internal dosimetry workshop; Albuquerque, NM, USA (20 Jan 1986).

PUQFUA2 is a computer code that calculates plutonium body burdens from urine assay data. The program is based on the power function elimination equations. The program includes a sample validation procedure, provisions to include specific dates of uptake in the calculation when potential accidents are identified, a procedure to generate urine sample data at 30-day intervals between actual validated urine samples, and the assumption that uptakes occur midway between validated or generated urine samples. 7 refs., 1 tab.

9863 (PNL-SA—14043, pp 125-140) **Description and application of the Aerosol Inhalation (AERIN) code at LLNL.** King, W.C. (Lawrence Livermore National Lab., CA). Mar 1987. NTIS, PC A18/MF A01. Order Number DE87014697/JAW. (CONF-860146—).

From Radiobioassay and internal dosimetry workshop; Albuquerque, NM, USA (20 Jan 1986).

The AERIN (Aerosol Inhalation) code was written to compute the organ burdens and absorbed dose resulting from a chronic or acute inhalation of transuranic isotopes. The code was revised in 1982 to reflect the concepts of ICRP 30. This paper describes the AERIN code and how it has been used to study more than 80 cases of internal deposition and obtain estimates of internal dose. A comparison with the computed values of the committed organ dose is made with ICRP-30 values. The benefits of using the code are described. 3 refs., 2 figs.

9864 (PNL-SA—14043, pp 141-152) **Internal dosimetry at Hanford.** Sula, M.J. Mar 1987. NTIS, PC A18/MF A01. Order Number DE87014697/JAW. (CONF-860146—).

From Radiobioassay and internal dosimetry workshop; Albuquerque, NM, USA (20 Jan 1986).

This report presents a summary of the internal dosimetry program at Hanford. Included are discussions of routine and nonroutine bioassay measurements, examples of action levels, and dose assessment and reporting methods. 7 refs., 3 tabs.

9865 (PNL-SA—14043, pp 153-161) **Rocky Flats dose assessment practices.** Coldren, L.E.; Falk, R.B. (Rockwell International, Golden, CO). Mar 1987. NTIS, PC A18/MF A01. Order Number DE87014697/JAW. (CONF-860146—).

From Radiobioassay and internal dosimetry workshop; Albuquerque, NM, USA (20 Jan 1986).

The assessment of dose for lung and systemic deposition is discussed for 1985 and earlier methodology. The methodology being developed to comply with the anticipated implementation by the Department of Energy of ICRP 30 requirements is also presented.

9866 (PNL-SA—14043, pp 163-174) **Developing a flexible and verifiable integrated dose assessment capability.** Parzyck, D.C.; Rhea, T.A.; Copenhaver, E.D.; Bogard, J.S. (Oak Ridge National Lab., TN). Mar 1987. NTIS, PC A18/MF A01. Order Number DE87014697/JAW. (CONF-860146—). Contract AC05-84OR21400.

From Radiobioassay and internal dosimetry workshop; Albuquerque, NM, USA (20 Jan 1986).

A flexible yet verifiable system of computing and recording personnel doses is needed. Recent directions in statutes establish the trend of combining internal and external doses. We are developing a Health Physics Information Management System (HPIMS) that will centralize dosimetry calculations and data storage; integrate health physics records with other health-related disciplines, such as industrial hygiene, medicine, and safety; provide a more auditable system with published algorithms and clearly defined flowcharts of system operation; readily facilitate future changes dictated by new regulations, new dosimetric models, and new systems of units; and address ad-hoc inquiries regarding worker/workplace interactions, including potential synergisms with non-radiation exposures. The system is modular and provides a high degree of isolation from low-level detail, allowing flexibility for changes without adversely affecting other parts of the system. 10 refs., 3 figs.

9867 (PNL-SA—14043, pp 177-192) **The sources of uncertainties associated with internal dose calculations.** Traub, R.J.; Robinson, A.V. (Pacific Northwest Lab., Richland, WA: United States Testing Company, Richland, WA). Mar 1987. NTIS, PC A18/MF A01. Order Number DE87014697/JAW. (CONF-860146—).

From Radiobioassay and internal dosimetry workshop; Albuquerque, NM, USA (20 Jan 1986).

There are uncertainties associated with internal dose calculations. The total uncertainty of internal dose calculations is a combination of the errors associated with each variable. Some of the variables are physical constants associated with a given radionuclide; the values of these variables are known with a fair degree of accuracy once the radionuclide that is providing the dose is identified. However, a high degree of uncertainty is associated with those variables. Either measurement of radioactive material in the body or the use of mathematical models for their estimation from measurements of radioactivity in excreta are required to estimate the uncertainty. The uncertainties associated with internal dosimetry may result in the loss of litigation solely because of the inability of health physicists to precisely define the dose received. 14 refs., 3 tabs.

9668 (PNL-SA—14043, pp 193-200) **Impact of LIS technology on internal dosimetry.** Faust, L.G.; Brackenbush, L.W. Mar 1987. NTIS, PC A18/MF A01. Order Number DE87014697/JAW. (CONF-860146—).

From Radiobioassay and internal dosimetry workshop; Albuquerque, NM, USA (20 Jan 1986).

Laser isotope separation (LIS) is the process that may be used to separate fissile isotopes, especially of transuranium elements. When applied to plutonium, the LIS process could result in almost pure plutonium-239 with the by-product containing the remaining isotopes. The by-product stream could be purified further to produce a specific plutonium isotope, such as plutonium-238, which is used for isotopic heat sources. The LIS process also can selectively produce any isotope, including plutonium-241. The reduction of plutonium-241, which is currently used as the isotope to determine levels of plutonium deposited in the lung. While the overall radiation exposures are effectively reduced by the LIS process, the external exposures are reduced more than the internal exposures. Generally, LIS technology is viewed as beneficial in reducing personnel exposures; however, the side effects of the process present some new challenges to the health physicist. 2 refs., 2 tabs.

9669 (PNL-SA—14043, pp 201-213) **Perspectives on the chemical and radiological hazards of uranium.** Stansbury, P.S. (General Electric Co., Wilmington, NC). Mar 1987. NTIS, PC A18/MF A01. Order Number DE87014697/JAW. (CONF-860146—).

From Radiobioassay and internal dosimetry workshop; Albuquerque, NM, USA (20 Jan 1986).

Uranium is unique among the elements because it presents chemical and radiological hazards of comparable magnitude. Although the biological effects of a heavy metal damaging the kidneys are vastly different from the actions of an alpha-emitting nuclide in the lung or bone tissues, there are some perceptual and phenomenological similarities of note to health physicists. In a broad sense, the amount of uranium that could cause chemical kidney damage or pose a radiation hazard could go unnoticed in the work place. Once taken into the body, the chemical action or the radiological insult progresses without any warning signals. Ultrasensitive bioassay techniques could detect the presence of uranium in the body and quantify an intake that is known to have occurred. The adverse health effect of either the chemical or radiological mode of action is catastrophic: kidney failure on one hand, cancer on the other. Two other parallelisms should be noted. The natural loss of nephrons is part of the aging process. Similarly 15 to 20% of the population die of naturally caused cancer. Thus, the effects of uranium exposure mimic natural effects in unexposed populations. There are suspected adverse health effects at low levels of exposure to uranium. Even though there may be good reasons for suspecting low-level effects, both chemical and radiological, there is very little definitive evidence that these effects occur in human populations. 7 refs., 1 fig., 1 tab.

9670 (PNL-SA—14043, pp 215-231) **Difficulties in in-vitro dose assessment due to chemical limitations.** Lardy, M.M.; Rotariu, G.J.; Robinson, A.V. (US Testing Company, Inc., Richland, WA; Department of Energy, Washington, DC). Mar 1987. NTIS, PC A18/MF A01. Order Number DE87014697/JAW. (CONF-860146—).

From Radiobioassay and internal dosimetry workshop; Albuquerque, NM, USA (20 Jan 1986).

This report describes some present major chemical problems associated with current in-vitro analyses (urine and feca!) for radionuclides of current major interest, such as strontium-89 and -90, uranium and plutonium-238, 239/240 (plutonium 239/240 means plutonium-239 and plutonium-240). 12 refs., 1 tab.

9671 (PNL-SA—14043, pp 233-245) **Bioassay of plutonium and uranium by fission track analysis.** Paschoa, A.S.; Bruenger, F.W.; Smith, J.M.; Singh, N.P.; Lewis, L.L.; Wrenn, M.E. (Utah Univ., Salt Lake City). Mar 1987. NTIS, PC A18/MF A01. Order Number DE87014697/JAW. (CONF-860146—). Contract AC02-76EV00119.

From Radiobioassay and internal dosimetry workshop; Albuquerque, NM, USA (20 Jan 1986).

An ultrasensitive method to measure ^{235}U and ^{239}Pu in human tissues, based on fission track analysis, is briefly described. Plutonium-239 concentrations in 25 aliquots of about 1 g, taken from six whole livers collected at autopsies of human subjects without any known occupational exposure to plutonium, were compared with the ^{239}Pu concentrations determined by alpha and mass spectrometry. About 1 femtocurie of ^{239}Pu can be measured in a single sample. The results obtained by fission track analysis indicated that ^{239}Pu was very uniformly distributed in these human livers. The potential application of fission track analysis to needle biopsies to measure ^{239}Pu burdens of about 5 picocurie or more in human liver is discussed. 3 refs., 1 fig., 2 tabs.

9672 (PNL-SA—14043, pp 257-263) **Uranium bioassays by laser phosphorimetry.** Gray, D.H. (Lovelace Inhalation Toxicology Research Institute, Albuquerque, NM). Mar 1987. NTIS, PC A18/MF A01. Order Number DE87014697/JAW. (CONF-860146—).

From Radiobioassay and internal dosimetry workshop; Albuquerque, NM, USA (20 Jan 1986).

The fluorometric method of determining uranium in fused NaF + LiF pellets is widely used for the assay of uranium. The method is reliable and relatively interference free, but suffers from being time-consuming and labor-intensive. Laser phosphorimetry offers simpler methodology and has been applied to determination of uranium in a number of different matrices. We have developed a method for the application of laser phosphorimetry to the determination of uranium in a wide variety of biological samples. These samples are typically tissue, bone, feces, or urine from Beagle dogs or rodents that were exposed by inhalation to well-characterized uranium-bearing aerosols under controlled conditions. Chemical treatment of these samples results in acid digests characterized by large amounts of dissolved ions and high acid concentration. 6 refs., 1 fig., 1 tab.

9673 (PNL-SA—14043, pp 265-276) **Internal dosimetry for uranium mill tailings.** Tschaeche, A.N.; Carr, R.; Rothman, B. (Bendix Field Engineering Corp., Grand Junction, CO). Mar 1987. NTIS, PC A18/MF A01. Order Number DE87014697/JAW. (CONF-860146—).

From Radiobioassay and internal dosimetry workshop; Albuquerque, NM, USA (20 Jan 1986).

The history, bases and initial proposed internal dosimetry program for the Uranium Mill Tailings Remedial Action Program are presented. 3 refs., 4 figs.

9674 (PNL-SA—14043, pp 279-291) **Intercalibration experiments with inhaled "mock plutonium".** Toohey, R.E. (Argonne National Lab., IL). Mar 1987. NTIS, PC A18/MF A01. Order Number DE87014697/JAW. (CONF-860146—).

From Radiobioassay and internal dosimetry workshop; Albuquerque, NM, USA (20 Jan 1986).

Review of the results of several intercalibration experiments performed with inhaled mock Pu over the past twenty years reveals that a calibration method based on the concept of effective soft tissue thickness gives acceptable results; most calibration methods used in 1972 were in error by as much as a factor of three; the Livermore phantom is an appropriate calibration method for males; and the Livermore phantom, with minimal modifications, will also provide suitable calibrations for females. Future studies may investigate the effect of particle size on the distribution of inhaled activity in the lungs and may extend the range of body sizes for which in vivo calibration data are available. 6 refs., 3 figs., 2 tabs.

9675 (PNL-SA—14043, pp 293-314) **Tissue-equivalent torso phantom for calibration of transuranic-nuclide counting facilities.** Griffith, R.V.; Anderson, A.L.; Dean, P.N.; Fisher, J.C.; Sundbeck, C.W. (Lawrence Livermore National Lab., CA). Mar 1987. NTIS, PC A18/MF A01. Order Number DE87014697/JAW. (CONF-860146—).

From Radiobioassay and internal dosimetry workshop; Albuquerque, NM, USA (20 Jan 1986).

Several tissue-equivalent human-torso phantoms have been constructed for the calibration of counting systems used for in-vivo measurement of transuranic radionuclides. The phantoms contain a simulated human rib cage and removable model organs, and they include tissue-equivalent chest plates that can be placed over the

torso to simulate people with a wide range of statures. The organs included are the lungs, liver, and tracheobronchial lymph nodes. Polyurethane with varying concentrations of added calcium was used to simulate the linear photon-attenuation properties of various human tissues, including lean muscle, adipose-muscle mixtures, cartilage, and bone. Foamed polyurethane was used to simulate lung tissue. Organs have been loaded with highly pure ^{238}Pu, ^{239}Pu, ^{241}Am, and other radionuclides of interest. The validity of the phantom as a calibration standard has been checked in separate intercomparison studies using human subjects whose lungs contained a plutonium simulant. The resulting phantom calibration factors generally compared to within +-20% of the average calibration factors obtained for the human subjects. 8 refs., 8 figs., 2 tabs.

9876 (PNL-SA—14043, pp 315-323) **Performance criteria for radiobioassay.** Heid, K.R.; Traub, R.J.; MacLellan, J.A. Mar 1987. NTIS, PC A18/MF A01. Order Number DE87014697/JAW. (CONF-860146—).

From Radiobioassay and internal dosimetry workshop; Albuquerque, NM, USA (20 Jan 1986).

In the course of employment, radioactive material may accidently be taken into the body. It is important that radiation protection programs be able to adequately assess the resulting deposition within the body. In 1979, the Health Physics Society chartered a working group to prepare an ANSI Standard N13.30. This standard specifies acceptable performance in minimum detection level, bias and precision for bioassay service laboratories providing services to the radiation protection community. The standard also provides a basis for testing service laboratories to evaluate their ability to meet the requirements of the standard. 2 tabs.

9877 (PNL-SA—14043, pp 325-342) **Technical evaluation of draft ANSI Standard N13.30, "Performance criteria for radiobioassay".** MacLellan, J.A.; Traub, R.J. Mar 1987. NTIS, PC A18/MF A01. Order Number DE87014697/JAW. (CONF-860146—).

From Radiobioassay and internal dosimetry workshop; Albuquerque, NM, USA (20 Jan 1986).

The Pacific Northwest Laboratory (PNL) is conducting a research program to evaluate the appropriateness of criteria in the ANSI draft Standard N13.30, "Performance Criteria for Radiobioassay." The evaluation has progressed parallel with the preparation of the Standard by evaluating the performance of existing bioassay laboratories against the criteria specified. Recommendations for revision of the Standard and implementation of a testing/accreditation program have been formulated based on study results. The current performance testing program includes both in-vivo counting and in-vitro sample measurements. Test criteria specified in the Standard include relative bias, relative precision, and acceptable minimum detectable activity (AMDA). Results indicate that the acceptance criteria in the Standard are appropriate for the existing state of the industry and are achievable by a majority of the participating laboratories. 3 refs., 11 figs.

9878 (PNL-SA—14043, pp 343-355) **Additional short-term plutonium urinary excretion data from the 1945-1947 plutonium injection studies.** Moss, W.D.; Gautier, M.A. (Los Alamos National Lab., NM). Mar 1987. NTIS, PC A18/MF A01. Order Number DE87014697/JAW. (CONF-860146—).

From Radiobioassay and internal dosimetry workshop; Albuquerque, NM, USA (20 Jan 1986).

A recent publication on the long-term urinary excretion of plutonium, 10,000 days after intravenous injection of known amounts, has shown that the amount of plutonium excreted per day is significantly higher than predicted by the Langham power function model. A review of the original injection experimental records was made because the published 10,000-day excretion data and observations made at Los Alamos and at the Oak Ridge National Laboratory have shown that at long times after occupational exposure, the urinary plutonium excretion deviates from the Langham power function model. Each of the Los Alamos National Laboratory notebooks used to record the analytical data was taken from storage and was studied for details that could influence the published findings. There were additional urine excretion data for case HP-3. This case was one of the two cases from which Rundo obtained the 10,000 day excretion rate. Remarks included in the notebooks suggest that there were some questions about the analytical methodology and an uncertainty with regard to the collection order. These two remarks may have influenced the exclusion of the data from the Langham report. The other case considered by Rundo was HP-6. 9 refs., 2 figs., 2 tabs.

9879 (PNL-SA—14043, pp 357-363) **Department of Energy Laboratory Accreditation Program for occupational exposure measurements.** Murphy, B.L. (Department of Energy, Washington, DC). Mar 1987. NTIS, PC A18/MF A01. Order Number DE87014697/JAW. (CONF-860146—).

From Radiobioassay and internal dosimetry workshop; Albuquerque, NM, USA (20 Jan 1986).

This paper will provide background information concerning the Department of Energy Laboratory Accreditation Program (DOELAP) for occupational exposure measurements and describe the process that will be used to plan and establish the actual accreditation program for bioassay. Specific details for the bioassay accreditation program cannot be provided at this time as ANSI N13.30, the standard upon which the program will be based, is still in the committee process. 3 figs.

9880 (PNL-SA—14043, pp 365-382) **Upgraded in vivo counting for plutonium, americium and uranium.** Palmer, H.E. Mar 1987. NTIS, PC A18/MF A01. Order Number DE87014697/JAW. (CONF-860146—).

From Radiobioassay and internal dosimetry workshop; Albuquerque, NM, USA (20 Jan 1986).

Significant advances in the measurement of ^{239}Pu, ^{241}Am, ^{235}U, and ^{233}U have been obtained over the past several years due to the availability of the Livermore Lung phantom and the mock plutonium study. Further improvements obtained through the use of arrays of high-purity planar germanium detectors were published. Even further improvements are needed if we are to achieve the ability to reliably measure pure ^{239}Pu lung burdens of 16 nCi or less in the average size radiation worker. Although there are many approaches that could provide improved measurement capability, only five of the more important ones will be discussed in this paper to stay within the time restraints. 8 refs., 7 figs.

9881 (PNL-SA—14043, pp 383-397) **Recent progress of the United States transuranium and Uranium Registries.** Kathren, R.L. Mar 1987. NTIS, PC A18/MF A01. Order Number DE87014697/JAW. (CONF-860146—).

From Radiobioassay and internal dosimetry workshop; Albuquerque, NM, USA (20 Jan 1986).

This paper provides a brief overview of the history and objectives of the US Transuranium and Uranium Registries along with a discussion of some recent activities and accomplishments of these two parallel programs. 16 refs.

9882 (PNL-SA—14043, pp 247-256) **Radionuclide measurements using resonantly enhanced collisional ionization.** Whitaker, T.J.; Bushaw, B.A.; Gerke, G.K. Mar 1987. NTIS, PC A18/MF A01. Order Number DE87014697/JAW. (CONF-860146—).

From Radiobioassay and internal dosimetry workshop; Albuquerque, NM, USA (20 Jan 1986).

This report describes development of a laser-enhanced collisional ionization method for direct radionuclide measurements that are independent of radioactive decay. The technique uses two nitrogen-laser-pumped dye lasers to selectively excite the target isotope to an electronic state near the ionization threshold. The excited actinide atoms then undergo collisions with a buffer gas and are efficiently ionized. The resulting ions can be detected by conventional methods. The attributes of this approach include highly sensitive isotope analysis with relatively inexpensive lasers and a simple vacuum system. 9 refs., 3 figs.

9883 (UCRL—97376) **The potential for new methods to assess human reproductive genotoxicity.** Mendelsohn, M.L. (Lawrence Livermore National Lab., CA (USA)). Sep 1987. Contract W-7405-ENG-48. 12p. (CONF-8705214—1). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88002505/JAW.

From International conference on cancer and human reproduction; Bethesda, MD, USA (11 May 1987).

The immediate prospects are not good for practical methods for measuring the human heritable mutation rate. The methods discussed here range from speculative to impractical, and at best are sensitive enough only for large numbers of subjects. Given the rapid development of DNA methods and the current status of two-dimensional gel electrophoresis, there is some hope that the intermediate prospects may be better. In contrast, the prospects for useful cellular-based male germinal methods seem more promising and immediate. Effective specific locus methods for sperm are already conceivable and may be practical in a few years. Obviously such methods will not predict heritable effects definitively, but they will provide direct information on reproductive genotoxicity and should contribute significantly to many current medical and environmental situations where genetic damage is suspected. 22 refs.

9884 **(UCRL—97473) Review of the state of the art in personnel neutron monitoring with solid state detectors.** Griffith, R.V. (Lawrence Livermore National Lab., CA (USA)). 2 Oct 1987. Contract W-7405-ENG-48. 22p. (CONF-871020—4). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88001875/JAW.

From 6. symposium on neutron dosimetry; Neuherberg, F.R. Germany (12 Oct 1987).

Albedo systems are the mainstay at many facilities and continue to be refined. Advanced electrochemical etching techniques for CR-39 now yield a dose equivalent response that is nearly constant from 0.1 to 4.0 MeV. Recent studies include use of converters to enhance CR-39 response at both low and high energies. Methods have been suggested for use of CR-39, either alone or in conjunction with albedo and other detectors to provide spectral information as a step to more accurate dosimetry. Limitations in the use of CR-39 primarily center on the lack of consistent, high-quality, dosimetry-grade material, significant angular dependence, and poor dose equivalent response at both low and high energies. Work continues on silicon diodes, with some new designs. The most attractive new dosimetry technique is the bubble-damage or superheated drop detector. Metal-on-silicon (MOS) microelectronics present exciting possibilities for the future. 25 refs., 6 figs.

9885 **Influence of template strandedness on in vitro replication of mutagen-damaged.** Larson, K.L.; Strauss, B.S. (Univ. of Chicago, IL). *Biochemistry;* **26**: No. 9, 2471-2479(5 May 1987).

The authors analyzed the ability of DNA polymerases to bypass damage on single- and double-stranded templates. In vitro DNA synthesis was studied on UV-irradiated and polyaromatic hydrocarbon reacted (benzo[a]pyrenediol epoxide and oxiranylpyrene) double-stranded templates by a protocol involving initiation on a uniquely nicked circular double-stranded template. The template was prepared by treating single-stranded (+)M13mp2 circular strands with mutagen and then hybridizing with restricted M13 RFmp2, followed by isolation of the nicked RFII forms. The protocol permits either (+), (-), or both strands to carry lesions. They found that the rules for termination and bypass of lesions previously observed with single-stranded DNA templates also hold for double-stranded templates. Termination of synthesis occurs primarily one nucleotide 3′ to the lesion in the template strand. Bypass of UV-induced lesions can be followed in a series of three partial reactions in the presence of Mn^{2+} and dGMP, which relax the specificity of nucleotide insertion and 3′ → 5′ exonuclease activity, respectively. There is no evidence for greater permissivity of bypass in double-as opposed to single-stranded templates. As with single-stranded templates, purines, and preferentially deoxyadenosine (dA) are inserted opposite lesions. Lesions in the nontemplate strand elicit neither termination nor pausing. The addition of Rec A protein resulted in a measurable increase of bypass in this system.

9886 **Action spectrum for the formation of endonuclease-sensitive sites and (6-4) photoproducts induced in a DNA fragment by ultraviolet radiation.** Chan, G.L.; Haseltine, W.A.; Peak, M.J.; Peak, J.G. (Harvard Medical School, Boston, MA, USA; Harvard School of Public Health, Boston, MA, USA; Argonne National Lab., IL, USA). *International Journal of Radiation Biology and Related Studies in Physics, Chemistry and Medicine;* **50**: No. 4, 641-648(Oct 1986).

Using DNA sequencing techniques, action spectra were prepared for the site-specific induction of cyclobutane pyrimidine dimers and hot-alkali sites (probably mostly 5-hydroxy-6-4-(5′-methylpyrimidine-2′-one)-dihydrothymine) in a DNA of defined sequence. The spectra for the formation of two different photoproducts were indistinguishable from each other. However, the absolute rates of induction of dimers and hot-alkali sites were different from each other, and varied from site to site. At 254, 270, and 290 nm, the spectra correlate with the action spectrum of DNA. At longer wavelengths (313 and 334 nm), the action spectra diverge from the DNA spectrum, with the efficiency of formation of both photoproducts being greater than the DNA spectrum.

9887 **Induction of proline prototrophs in CHO-K1 cells by heavy ions.** Mei, M.-T.; Craise, L.M.; Yang, T.C.H. (Lawrence Berkeley Lab., CA, USA). *International Journal of Radiation Biology and Related Studies in Physics, Chemistry and Medicine;* **50**: No. 2, 213-224(Aug 1986).

Using an established mammalian cell line, Chinese hamster ovary cells (CHO-K1), we have observed the induction of prototrophs by various heavy ions. This cell line requires proline for normal growth in medium with low serum concentration. X-rays, three types of heavy particles (600 MeV/u iron, 670 MeV/u neon, and 320 MeV/u silicon ions), ethylmethane sulphonate and 5-azacytidine were used to induce revertants which were proline independent. Log-phase cells treated with 5-azacytidine showed a very high reversion frequency. The induction frequency per viable cell appears to be dose dependent for these four types of radiation, and the dose-response curves are approximately linear. Our results also indicate that the effectiveness of high-LET particles in inducing proline prototrophs is much greater than that of low-LET radiation. The RBE value for the induction of prototrophs was calculated for neon, silicon, and iron particles and found to be about 1.3, 1.7 and 4.5, respectively. At equal survival level, the reversion frequency for X-rays and EMS was about the same.

9888 **Molecular analysis of X-ray-induced mutants at the HPRT locus in V79 Chinese hamster cells.** Fuscoe, J.C.; Ockey, C.H.; Fox, M. (Lawrence Livermore National Lab., CA, USA; Christie Hospital and Holt Radium Inst., Manchester, UK. Paterson Labs.). *International Journal of Radiation Biology and Related Studies in Physics, Chemistry and Medicine;* **49**: No. 6, 1011-1020(Jun 1986).

Spontaneous and X-ray-induced mutants at the hypoxanthine phosphoribosyl transferase (HPRT) locus have been isolated from V79 Chinese hamster cells and characterized at the biochemical and cytogenetic levels. Fourteen spontaneous and 24 X-ray-induced clones were azaguanine and thioguanine resistant, did not grow in HAT medium (AZsup(R)TGsup(R)HATsup(S)) and failed to incorporate significant levels of [^{14}C]hypoxyanthine. Cytogenetic analysis of two spontaneous and eight X-ray-induced mutants revealed no major X chromosome rearrangements. In two induced mutants, one of which was hypotetraploid (mode 35-39) with 2 X chromosomes, the short arm of the chromosome (Xp) was slightly shorter than normal. A third mutant was hyperdiploid (mode 22-23) compared with the parental clone (mode 21). Compared with wild-type clones, no other cytogenetic changes were evident in the remaining mutants. Analysis showed major deletion of HPRT sequences in two and partial deletion in another two induced mutants. In two mutants with deletions of HPRT sequences there was a visible shortening of the Xp arm. In the other six mutants (two spontaneous and four induced) no karyotypic changes or alterations in restriction fragment patterns were detected suggesting that they carry small deletions or point mutations at the HPRT locus.

9889 **2-[(aminopropyl)amino]ethanethiol (WR1065) is anti-neoplastic and anti-mutagenic when given during ^{60}Co γ-ray irradiation.** Hill, C.K.; Nagy, B.; Peraino, C.; Grdina, D. (Argonne National Lab., IL, USA). *Carcinogenesis;* 7: No. 4, 665-668(Apr 1986).

The effect of 2[(aminopropyl)amino]ethanethiol (WR1065) has been studied on the induction of neoplastic transformation using 10T1/2 cells and on mutation of the hypoxanthine guanine phosphoribosyl transferase (HGPRT) locus using Chinese hamster V79 cells. The first observations that treatment of 10T1/2 cells with 1 mM WR1065 for a total of 35 min during irradiation with ^{60}C γ-rays significantly reduces the incidence of neoplastic transformation while having no effect on cell viability are reported. In a similar experiment with V79 cells in which 4mM WR1065 was used, a significant reduction in mutation frequency at the HGPRT locus and significant protection against cell killing was found. These results suggest that WR1965 acts to modulate both acute damage and sublethal processes that lead to mutation and neoplastic transformation. Beyond the purely mechanistic approach of these studies, the potential application of these agents to minimizing the long-term neoplastic effects of radiation or chemotherapeutic agents currently in use for treating potentially curable cancer patients should be further investigated.

9890 **Problems related to the critical depth of skin.** Roesch, W.C. (Pacific Northwest Lab., Richland, WA, USA). *Radiation Protection Dosimetry;* 14: No. 2, 91-93(1986). (CONF-8510185—). Contract AC06-76RL01830.

From Workshop on dosimetry of beta particles and low energy X-rays; Paris, France (7 Oct 1985).

Concern over beta particle dosimetry in the United States led to a number of workshops and symposia at which the National Council on Radiation Protection and Measurements (NCRP) was encouraged to review its recommendations about beta particles. The NCRP responded by forming Scientific Committee No. 80 on Radiobiology of the Skin to start the review. It was directed to prepare recommendations concerning: (1) the depth(s) in the skin at which dose measurements shall be made, (2) the range of depths over which the dose can be averaged, (3) the area of the skin over which the dose can be averaged, and (4) what measurements are required in protecting the whole skin. The recommendations are to apply to all radiations, not just to beta particles. How the measurements are to be made will be left to a later committee. The committee is not required to recommend permissible doses for the skin. The committee has met five times so far to examine the information available on the stochastic and non-stochastic responses of the skin to both ionising and non-ionising radiations.

9891 **Radiation-induced damage in the central nervous system: an interpretation of target cell responses.** Kogel, A.J. van der. (Los Alamos National Lab., NM, USA; New Mexico Univ., Albuquerque, USA. Dept. of Radiology). *British Journal of Cancer;* 53: No. Suppl. 7, 207-217(1986). (CONF-8509427—).

From 12. L.H. Gray conference on assays of normal tissue injury and their cellular interpretation; Manchester, UK (2 Sep 1985).

In the present report the contribution of radio-biological studies to the understanding of late radiation-induced damage in the CNS is reviewed from 1934. An attempt is made to combine some of the results obtained by Zeman and co-workers (1964) with more recent data into a model of target cell responses in the CNS.

9892 **Mechanisms of DNA damage and repair: Implications for carcinogenesis and risk assessment.** Simic, M.G.; Grossman, L.; Upton, A.C. (eds.). New York, NY; Plenum Press (1986). 561p. (CONF-850663—). Plenum Press, 233 Spring Street, New York, NY 10013. Order Number TI87007559/JAW. Contract AI01-85ER60321.

From International conference on DNA damage and repair - implications for carcinogenesis and risk assessment; Gaithersburg, MD, USA (3 Jun 1985).

This book is based on the papers presented at the conference on "Mechanisms of DNA Damage and Repair: Implications for Carcinogenesis and Risk Assessment," held at the National Bureau of Standards on June 2-7, 1985. This volume deals with mechanisms of DNA damage and repair at the molecular level; consequences of unrepaired or misrepaired damage, with major emphasis on carcinogenesis; drugs which bind selectively to altered and potentially damaging DNA sequences; and potential utilization of DNA damage as an endpoint for assessing risks of uv light, ionizing radiations, chemicals, drugs, and hazardous agents in foods. Because the induction of mutations by radiation and genotoxic chemicals has been observed to follow one-hit kinetics in some instances, it is generally assumed that any level of exposure to a DNA-damaging agent may increase the risk of genetic disease or cancer in an exposed population. At the same time, however, there is evidence that although the DNA of living cells is continually damaged by natural background radiation, free radicals, and other naturally occurring processes, most of the damage is normally repaired. Knowledge of the intricate relationships between the toxicity of hazardous agents and the level of exposure, possible synergistic effects of exposure to other agents, damage to DNA and its repair or misrepair, repair capacity of the affected cells, and the factors influencing the processes of damage and repair at various stages in their evolution are essential for understanding molecular carcinogenesis and for developing scientifically based risk assessment.

9893 **Introduction to mechanisms of DNA damage and repair.** Simic, M.G. (National Bureau of Standards, Gaithersburg, MD). pp 1-8 of Mechanisms of DNA damage and repair: Implications for carcinogenesis and risk assessment. Simic, M.G.; Grossman, L.; Upton, A.C. (eds.). New York, NY; Plenum Press (1986). (CONF-850663—).

From International conference on DNA damage and repair - implications for carcinogenesis and risk assessment; Gaithersburg, MD, USA (3 Jun 1985).

Free radicals in model systems and in cells eventually disappear. The radicals may react with each other by disproportionation, in which single molecular products are formed, or by combination, in which cross-links are formed. They can also be oxidized or reduced by endogenous and exogenous redox agents, depending on their nature. In the presence of oxygen, reaction of these radicals with oxygen becomes prominent, with the extent of the reaction depending on parameters such as relative reactivities, concentrations, and mobilities. For example, DNA-R + O_2 → DNA-ROO dot → DNA-P/sub ox/ where DNA-P/sub ox/ represents a variety of oxidation products, some of them specific to autoxidation processes.

9894 **History of radiation biology from a personal point of view.** Hollaender, A. (Associated Universities, Inc., Washington, DC). pp 9-17 of Mechanisms of DNA damage and repair: Implications for carcinogenesis and risk assessment. Simic, M.G.; Grossman, L.; Upton, A.C. (eds.). New York, NY; Plenum Press (1986). (CONF-850663—).

From International conference on DNA damage and repair - implications for carcinogenesis and risk assessment; Gaithersburg, MD, USA (3 Jun 1985).

A personal account is presented by the author of his role in the development of radiobiology at the Rockefeller Foundation in the 1930's, at the National Institutes of Health (NIH) in the late 30's and early 40's and at Oak Ridge in the late 40's to the mid 60's. (DT)

9895 **Comparison of mechanisms for DNA strand break formation by the direct and indirect effect of radiation.** Schulte-Frohlinde, D. (Max-Planck-Institut fuer Strahlenchemie, Mulheim a.d. Ruhr, Germany). pp 19-27 of Mechanisms of DNA damage and repair: Implications for carcinogenesis and risk assessment. Simic, M.G.; Grossman, L.; Upton, A.C. (eds.). New York, NY; Plenum Press (1986). (CONF-850663—).

From International conference on DNA damage and repair - implications for carcinogenesis and risk assessment; Gaithersburg, MD, USA (3 Jun 1985).

Irradiation of cells may lead to mutations, reproductive cell death and the disappearance of some or all cell activities. These effects, especially reproductive cell death, are believed to be the result of damage to DNA. Two kinds of formation of DNA damage are often distinguished, the so-called "direct" and the "indirect" effect of irradiation. The direct effect is due to ionization or electronic excitation of the DNA, and the indirect effect is caused

by reactive species, in most cases free radicals, which are produced in the vicinity of the DNA. These radicals may be primary radicals produced by energy absorption in water, i.e., the solvated electron, the H-atom and the OH radical, or organic radicals produced from organic material other than DNA either by interaction with radiation or by reaction with the primary radicals generated from water. 36 refs., 2 figs., 2 tabs.

9006 **Differential regulation of base and nucleotide excision repair in mammalian cells.** Erixon, K. (Univ. of Stockholm, Sweden). pp 159-170 of Mechanisms of DNA damage and repair: Implications for carcinogenesis and risk assessment. Simic, M.G.; Grossman, L.; Upton, A.C. (eds.). New York, NY; Plenum Press (1986). (CONF-850663—).

From International conference on DNA damage and repair - implications for carcinogenesis and risk assessment; Gaithersburg, MD, USA (3 Jun 1985).

In this study, repair mechanisms have been deduced through the use of a sensitive and convenient technique to measure single-strand breaks (SSB) in cellular DNA, named Alkaline DNA Unwinding (ADU). The level of SSB has been followed in human fibroblasts of normal xeroderma pigmentosum origin after exposure to 8 different genotoxic agents. These agents fall into two distinct groups. The first group is represented by uv light and uv-mimetic agents that will introduce bulky DNA adducts, for which xp-cells have a decreased repair capacity and survival. The second group contains simple alkylating agents that will introduce methyl and ethyl-groups on DNA for which xp-cells have more or less normal repair and survival. Lesions produced by the first group are believed to be recognized by direct acting endonucleases by virtue of the local distortion of the DNA helix. Lesions formed by the second group of agents are recognized by a different set of enzymes, glycosylases, that cleave off modified bases, e.g., 3-methyladenine (3-MeAd) and 7-methylguanine (7-MeGu), the major adducts after treatment with dimethylsulphate or methyl methansulphonate. The resulting apurinic sites (AP-sites) are then cut by AP-endonucleases, giving rise to SSBs. This repair pathway, sometimes called base excision repair or short patch repair, has been claimed to produce primarily short repair patches, 1 to 3 inserted deoxynucleotides. Repair of uv-mimetic lesions by nucleotide excision results in patches 25 to 100 deoxynucleotides long, hence the name long patch repair. 25 refs., 8 figs., 1 tab.

9007 **Immediate and repair induced DNA double strand breaks in mammalian cells.** Bryant, P.E. (Univ. of St. Andrews, United Kingdom). pp 171-180 of Mechanisms of DNA damage and repair: Implications for carcinogenesis and risk assessment. Simic, M.G.; Grossman, L.; Upton, A.C. (eds.). New York, NY; Plenum Press (1986). (CONF-850663—).

From International conference on DNA damage and repair - implications for carcinogenesis and risk assessment; Gaithersburg, MD, USA (3 Jun 1985).

It seems logical to postulate that double strand breaks (dsb) arising both at the time of irradiation and via repair processes are potentially equally damaging for a cell in terms of the potential to induce chromosomal aberrations. However, in some cell systems the repair of double es or es-esb sites may run concurrently with the incision so that these lesions do not remain open for long: hence the lack of accumulation of dsb during repair. The rate of incision will thus determine both the accumulation and the probability of exchanges leading to chromosomal aberrations between these and other frank dsb. Rapid incision leading to a large additional pool of dsb appears to be the case in Chinese hamster V79 cells. Some evidence also exists for the conversion of base damage, via dsb, into deletion type chromatid aberrations which accumulate in irradiated G2 human cells treated with ara C. A small fraction of dsb, probably arising both at the time of irradiation as well as enzymatically during repair of base or sugar damage, appears to be either left unrepaired, yielding deletion type chromosomal aberrations, or is misrepaired, yielding exchange aberrations. The induction of these aberrations appears to be of central importance in the biological effects of ionizing radiation such as mutations, oncogenic transformation, and cell death. 52 refs., 5 figs.

9008 **Pyrimidine dimers induced alteration of DNA tertiary structure evidence for unwinding and shortening.** Pedrini, A.M.; Tornaletti, S.; Menichini, P.; Abbondandolo, A. (Istituto di Genetica Biochimica ed Evoluzionistica, CNR, Pavia, Italy; Istituto Scientifico Tumori, Genoa, Italy). pp 295-301 of Mechanisms of DNA damage and repair: Implications for carcinogenesis and risk assessment. Simic, M.G.; Grossman, L.; Upton, A.C. (eds.). New York, NY; Plenum Press (1986). (CONF-850663—).

From International conference on DNA damage and repair - implications for carcinogenesis and risk assessment; Gaithersburg, MD, USA (3 Jun 1985).

Circular closed DNA molecules have been utilized for the study of the structural alterations induced by pyrimidine dimers to DNA in solution. By analyzing the alterations in the electrophoretic mobility on agarose gel of these molecules caused by pyrimidine dimers, we have detected a modification either in the unwinding angle or in the size of the molecules. Furthermore, we have been able to exclude that these two effects could be due to the disruption of hydrogen bonds at the site of the damage, although these alterations can cause unwinding and can create regions of flexibility that easily would collapse, making the molecule more compact. Unwinding results in the variation of the twist number, while reduction in the effective length of DNA resulting by bending the helix axis at the site of the damage alters the writhing number. 17 refs., 3 figs.

9009 **Mechanisms of mutagenesis of E. coli by ultraviolet light.** Hutchinson, F.; Wood, R.D. (Yale Univ., New Haven, CT). pp 377-383 of Mechanisms of DNA damage and repair: Implications for carcinogenesis and risk assessment. Simic, M.G.; Grossman, L.; Upton, A.C. (eds.). New York, NY; Plenum Press (1986). (CONF-850663—).

From International conference on DNA damage and repair - implications for carcinogenesis and risk assessment; Gaithersburg, MD, USA (3 Jun 1985).

This summary shows that uv mutagenesis involves several processes and several types of mutations. It is important to know, if some step or event affects, say, uv-induced reversion of a his mutant, what kinds of mutation cause the reversion. More, if reversion of the mutant is not affected, it is essential to know what kinds of mutation are involved, because statements can only be made about these mutations, and not about uv mutagenesis in general. It is also clear that the spectrum of mutations will depend on dose. Thus, extrapolation from experimental data at high dose to low dose situations involve considerations both of numbers and of kinds of mutations. Extrapolation of these results to other organisms may be particularly difficult because the SOS functions play such a large role in uv mutagenesis of E. coli. 34 refs., 1 tab.

9000 **Background levels of DNA damage in the population.** Saul, R.L.; Ames, B.N. (Univ. of California, Berkeley). pp 529-535 of Mechanisms of DNA damage and repair: Implications for carcinogenesis and risk assessment. Simic, M.G.; Grossman, L.; Upton, A.C. (eds.). New York, NY; Plenum Press (1986). (CONF-850663—).

From International conference on DNA damage and repair - implications for carcinogenesis and risk assessment; Gaithersburg, MD, USA (3 Jun 1985).

A variety of naturally-occurring agents and processes cause DNA damage in man, including sunlight dietary mutagens. These processes can lead to at least six major types of DNA damage: base loss, base deamination, base alkylation, base dimerization, base oxidation, and single-strand breakage. Estimates of the rates of production of these lesions have been made for the average human cell of about 26,000 base losses per day, primarily purines lost because of spontaneous hydrolysis of the glycosyl bond; about 350 cytosine deaminations per day; tens of thousands of base alkylations per day, primarily methylations of guanine caused by S-adenosylmethionine; up to 50,000 pyrimidine dimerizations per day, dependent upon exposure to sunlight; and about 100,000 single-strand breaks per day. Based upon measurements of DNA oxidation products in human urine, we estimate that the total rate of formation of all oxidative DNA damage products in man is on the order of a few thousand events per cell per day. In addition, base mispairing can take place in the absence of DNA damage because of tautomeric shifts, base

ionization, or base rotation. Such estimates of DNA lesion formation are only very approximate because they are based on limited data, and in most cases have not been corrected for the many possible influences of tertiary and quaternary DNA structure and the presence of histones, divalent cations, and other factors in vivo. The biological importance of each particular lesion is difficult to access, since this depends not only on the rate of formation, but also on the persistence and chemical nature of that lesion within the DNA. The steady-state concentrations of most lesions are probably very low in vivo because of a variety of efficient DNA repair enzymes that repair damage, and proof-reading enzymes that correct base mismatching. 23 refs., 2 tabs.

9001 **Electron spin resonance studies of the mechanism of radiation damage to DNA.** Cullis, P.M.; Symons, M.C.R. (Leicester Univ., United Kingdom). pp 29-37 of Mechanisms of DNA damage and repair: Implications for carcinogenesis and risk assessment. Simic, M.G.; Grossman, L.; Upton, A.C. (eds.). New York, NY; Plenum Press (1986). (CONF-850663—).

From International conference on DNA damage and repair - implications for carcinogenesis and risk assessment; Gaithersburg, MD, USA (3 Jun 1985).

Electron spin resonance spectroscopy has only been used successfully on dry DNA at room temperature or on aqueous DNA at low temperatures. Under these conditions the direct damage results in electron-loss, which initially is indiscriminate, but rapidly ends up as G dot $^+$, which is stable up to ca. 210°K. Electrons are trapped at T, giving T dot $^-$ anions, which are converted into dot TH in the 130 to 208°K range. Above these temperatures, both centers decay without the clear appearance of other intermediate radicals. Arguments are given against the concept that holes and/or electrons are extensively mobile within DNA molecules, and also against the concept that the ionic species studied by ESR spectroscopy recombine to give G and T to a major extent. In the presence of oxygen, O_2^- ions were detected and the primary yield of T dot $^-$ was reduced. However, both primry centers were lost at relatively low temperatures, with the concomitant formation of RO_2 dot radicals. The fate of these and the O_2 dot $^-$ anions could not be determined by ESR spectroscopy. In the presence of hydrogen peroxide or iodoscetamide, electrons were effectively scavenged, giving dot OH and H_2 C dot ONH_2 radicals and a reduced yield of T dot $^-$. These active radicals were rapidly converted into new alkyl-type radicals, thought to be primarily formed by hydrogen atom abstraction. The ESR signals due to these radicals were lost at temperatures below those characteristic of the primary centers. This shows that these may well have been converted into such alkyl radical centers by hydrogen atom transfer despite our inability to detect them. 17 refs., 7 figs.

9002 **Free radical mechanisms of DNA base damage.** Simic, M.G.; Jovanovic, S.V. (National Bureau of Standards, Gaithersburg, MD). pp 39-49 of Mechanisms of DNA damage and repair: Implications for carcinogenesis and risk assessment. Simic, M.G.; Grossman, L.; Upton, A.C. (eds.). New York, NY; Plenum Press (1986). (CONF-850663—).

From International conference on DNA damage and repair - implications for carcinogenesis and risk assessment; Gaithersburg, MD, USA (3 Jun 1985).

Comprehensive understanding of free radical reactions with DNA is still lacking, in spite of major advances in the last ten years. Therefore, only the general features of model systems can be presented in this short review, and the possible consequences of the overall damage to DNA are discussed. 32 refs., 2 tabs.

9003 **Peroxyl radicals of nucleic acids and their components.** von Sonntag, C. (Max-Planck-Institut fuer Strahlenchemie, Mulheim a.d. Ruhr, Germany). pp 51-59 of Mechanisms of DNA damage and repair: Implications for carcinogenesis and risk assessment. Simic, M.G.; Grossman, L.; Upton, A.C. (eds.). New York, NY; Plenum Press (1986). (CONF-850663—).

From International conference on DNA damage and repair - implications for carcinogenesis and risk assessment; Gaithersburg, MD, USA (3 Jun 1985).

If free radicals add to the bases of nucleic acids or abstract a hydrogen atom from the sugar moiety, mainly carbon-centered radicals are formed. In the presence of oxygen such carbon-centered radicals are converted into the corresponding peroxyl radicals at nearly diffusion-controlled rates ($k \approx 2 \times 10^9\ M^{-1}\ s^{-1}$). Our knowledge of the free-radical chemistry of purines, especially in the presence of oxygen, is at present still very limited, so that this discussion must be restricted to pyrimidines and to the sugar moiety. This article attempts to make the reader familiar with some of the complexities of peroxy radical reactions and to give some examples of how such reactions are reflected in the degradation of the free components of nucleic acids, and to what extent such results may be extrapolated to the nucleic acids themselves. 30 refs., 1 tab.

9004 **Radiation-induced peroxidation of DNA and effects of redox-active agents.** Frew, J.E.; Jones, P.; Scholes, G. (Univ. of Newcastle Upon Tyne, England). pp 61-67 of Mechanisms of DNA damage and repair: Implications for carcinogenesis and risk assessment. Simic, M.G.; Grossman, L.; Upton, A.C. (eds.). New York, NY; Plenum Press (1986). (CONF-850663—).

From International conference on DNA damage and repair - implications for carcinogenesis and risk assessment; Gaithersburg, MD, USA (3 Jun 1985).

With nucleic acids present as solutes in the irradiated solutions the chemical evidence, reviewed briefly below, is that the observed peroxidation is associated with hydroxyhydroperoxides formed on the pyrimidine components of polynucleotides. Such peroxidation of DNA has long interested radiobiologists in view of its possible relevance to the well-known oxygen effect in radiation biology, viz., the marked sensitizing effects of oxygen on radiation damage to living cells. In this connection questions arise concerning the post-irradiation fate of the hydroxyhydroperoxides produced in situ on the genetic material. If this were to involve some metal-ion catalyzed decomposition (e.g., by transition metal cations) there is the possibility that this could lead to further radical-initiated DNA lesions. With this possibility in mind we considerd it of interest, in the first instance, to investigate the effects of some transition metal ions on the stability of hydroxyhydroperoxides produced on irradiation of various pyrimidine compounds and polynucleotides, and some of our results are presented in the second part of this paper. Finally, we present some preliminary results on the effect of bleomycin, a redox-active anticancer drug, on DNA hydroxyhydroperoxide. 16 refs., 2 figs.

9005 **The radiation chemistry of the purine bases within DNA and related model compounds.** Cadet, J.; Berger, M.; Shaw, A. (Centre d'Etudes Nucleaires de Grenoble, France). pp 69-74 of Mechanisms of DNA damage and repair: Implications for carcinogenesis and risk assessment. Simic, M.G.; Grossman, L.; Upton, A.C. (eds.). New York, NY; Plenum Press (1986). (CONF-850663—).

From International conference on DNA damage and repair - implications for carcinogenesis and risk assessment; Gaithersburg, MD, USA (3 Jun 1985).

Both the direct and indirect effects of ionizing radiations are believed to contribute to the chemical changes induced in cellular DNA. Relevant information on the possible degradation pathways has been provided by studies using DNA model compounds, the major proportion of which have focused on pyrimidine components and sugar derivatives. With the development of powerful analytical tools such as high performance liquid chromatography and soft ionization mass spectrometry techniques, progress has recently been made in the elucidation of the nature of the radiation-induced chemical modifications of purine bases in DNA and related nucleosides and nucleotides. This short review details recent aspects of the radiation-induced degradation of adenine and guanine bases in DNA and its model compounds as the result of both direct and indirect effects. 11 refs., 2 figs., 1 tab.

9006 **Bacteriophage DNA as a model for correlation of radical damage to DNA and biological effects.** Blok, J.; Loman, H. (Free Univ., Amsterdam, Netherlands). pp 75-87 of Mechanisms of DNA damage and repair: Implications for carcinogenesis and risk assessment. Simic, M.G.; Grossman, L.; Upton, A.C. (eds.). New York, NY; Plenum Press (1986). (CONF-850663—).

From International conference on DNA damage and repair - implications for carcinogenesis and risk assessment; Gaithersburg, MD, USA (3 Jun 1985).

The purpose of the present paper is to discuss the reactions of the water radiolysis products with DNA and to assess the extent to which the biological functioning of DNA is affected by such reactions. This discussion focusses on the radiation effects in the DNA that can be isolated from the bacteriophage phiX174. Under suitable conditions it can be transfected to Escherichia coli cells. After infection of bacterial cells the first step produces a double-stranded, closed circular DNA molecule that is called RF-DNA (replicative form). A decrease of the biological activity of the single-stranded form after irradiation is therefore either due to damage inhibiting the synthesis of the RF, e.g., strand breaks, or other damage that does not block the synthesis of the first RF molecule, but inhibits the further processes required for the production of viable bacteriophage particles. 21 refs., 5 figs., 3 tabs.

9907 **Ultrafast chemical repair of DNA single and double strand break precursors in irradiated V79 cells.** Michael, B.D.; Davies, S.; Held, K.D. (Mount Vernon Hospital, Northwood, England; Massachusetts General Hospital, Boston). pp 89-100 of Mechanisms of DNA damage and repair: Implications for carcinogenesis and risk assessment. Simic, M.G.; Grossman, L.; Upton, A.C. (eds.). New York, NY; Plenum Press (1986). (CONF-850663—).

From International conference on DNA damage and repair - implications for carcinogenesis and risk assessment; Gaithersburg, MD, USA (3 Jun 1985).

The fast kinetics of reactions of free radical precursors of DNA single strand breaks (ssb) and double strand breaks (dsb) have been determined in Chinese hamster V79 cells by fast mixing and irradiation methods using the alkaline unwinding technique to assay breaks. Fast chemical repair of oxygen-dependent ssb and dsb precursors was observed and approached completion within 10 to 20 ms of irradiation. Treatment of cells with the glutathione synthesis blocking agent, buthionine sulphoximine, showed that approximately half of the chemical repair was attributable to intracellular non-protein thiols. The nature of the residual repair is obscure, but it is apparently not attributable to non-protein thiols. Similar repair rates and thiol dependences were also found for cell kill. With all three endpoints, oxygen competes with and blocks the chemical repair. 36 refs., 6 figs., 1 tab.

9908 **Ionizing radiation induced DNA damage: Identities and DNA repair.** Ward, J.F. (Univ. of California at San Diego, La Jolla). pp 135-138 of Mechanisms of DNA damage and repair: Implications for carcinogenesis and risk assessment. Simic, M.G.; Grossman, L.; Upton, A.C. (eds.). New York, NY; Plenum Press (1986). (CONF-850663—).

From International conference on DNA damage and repair - implications for carcinogenesis and risk assessment; Gaithersburg, MD, USA (3 Jun 1985).

When cells are irradiated with low LET radiation the total dose of energy deposited per unit mass can be measured with great accuracy. In contrast, treatments with other agents can have problems of agent activation, diffusion or delivery to the target. With ionizing radiation the major problem is in the assignment of biological significance to any particular lesion. Model studies have indicated that a myriad of chemically distinct lesions can be produced. 14 refs., 1 fig.

9909 **Effects of LET/sub ∞/ on the fate of DNA damage induced in rabbit sensory cells in situ: Fundamental aspects.** Lett, J.T.; Bertold, D.S.; Keng, P.C. (Colorado State Univ., Ft. Collins; National Bureau of Standards, Gaithersburg, MD; Univ. of Rochester Medical Center, NY). pp 139-150 of Mechanisms of DNA damage and repair: Implications for carcinogenesis and risk assessment. Simic, M.G.; Grossman, L.; Upton, A.C. (eds.). New York, NY; Plenum Press (1986). (CONF-850663—). Contract AC03-76SF00098.

From International conference on DNA damage and repair - implications for carcinogenesis and risk assessment; Gaithersburg, MD, USA (3 Jun 1985).

Following doses of ionizing radiation, nondividing photoreceptor cells of the rabbit retina seem able to repair DNA damage and restore DNA superstructure, although they may take as long as several weeks to do so. Since retinal photoreceptor cells remain locked in the G_0 phase of the cell cycle throughout their lifetimes, the restoration of DNA superstructure from various kinds of DNA damage does not require the participation of DNA replication. Whether the repair of DNA damage and the restitution of DNA superstructure can be completed in the G_0 phase of the cell cycle is still unknown because of the limiting sensitivity of the analytical techniques and because the repaired DNA in irradiated cells deteriorates earlier than the DNA in the unirradiated counterparts. Proliferating cells may die from radiation damage because they engage in other cellular functions before otherwise competent repair mechanisms have time sufficient to finish their tasks. Fully differentiated, nondividing cells in the central nervous systems of individuals exposed to densely ionizing radiations, and especially astronauts exposed to heavy ions in outer space, are likely to exhibit late radiation sequelae that are dependent on LET/sub ∞/. 34 refs., 7 figs., 1 tab.

9910 **Radiation damage to DNA in various animal tissues: A comparison of yields and repair in vivo and in vitro.** Meyn, R.E.; Jenkins, W.T.; Murray, D. (Univ. of Texas System Cancer Center, Houston). pp 151-158 of Mechanisms of DNA damage and repair: Implications for carcinogenesis and risk assessment. Simic, M.G.; Grossman, L.; Upton, A.C. (eds.). New York, NY; Plenum Press (1986). (CONF-850663—).

From International conference on DNA damage and repair - implications for carcinogenesis and risk assessment; Gaithersburg, MD, USA (3 Jun 1985).

The results reviewed here add weight to the idea that cultured mammalian cells irradiated in equilibrium with air may not appropriately mimic the response of cells comprising normal tissues irradiated in vivo. The major differences appear to involve at least two parameters: the degree of oxygenation and the state of differentiation. The degree of oxygenation may have more effect on the initial yield of lesions produced both in type and number, whereas the state of proliferative versus nonproliferative state may influence the repair rates. Thus, these factors could have important consequences with respect to radiation-induced cell killing, carcinogenesis, and mutation because of the envisioned role of DNA damage and repair mechanisms in these processes. 25 refs., 2 figs., 3 tabs.

9911 **Biological behavior of erythrocytes labeled in vivo and in vitro with technetium-99m.** Atkins, H.L.; Srivastava, S.C.; Meinken, G.E.; Richards, P. (State Univ. of New York, Stony Brook). *Journal of Nuclear Medicine Technology;* **13**: No. 3, vp(Sep 1985).

The in vitro method of red blood cell labeling was compared to the commonly used in vivo technique to evaluate labeling efficiency, levels of radioactivity in cells, plasma, and urinary excretion. Comparative studies were performed on nine normal volunteers. In two subjects, in vivo labeling did not occur. In the other subjects, the maximum blood activity (5 min after administration for the in vitro method and 15-120 min for the in vivo method) was 18% higher with the in vitro method. Whole body retention of radioactivity was higher with the in vivo method. With the in vitro method it was 66.3 +/- 9.0%. It is concluded that the in vitro method of red cell labeling provides significantly higher blood levels of radioactivity at the times required for data collection but reduced whole body retention over 24 hr.

5602 Thermal Effects

REFER ALSO TO CITATION(S) 9961

9912 **DNA-protein cross-links: New insights into their formation and repair in irradiated mammalian cells.** Oleinick, N.L.; Chiu, Song-mao; Friedman, L.R.; Xue, Liang-yan; Ramakrishnan, N. (Case Western Reserve Univ., Cleveland, OH). pp 181-192 of Mechanisms of DNA damage and repair: Implications for carcinogenesis and risk assessment. Simic, M.G.; Grossman, L.; Upton, A.C. (eds.). New York, NY; Plenum Press (1986). (CONF-850663—).

From International conference on DNA damage and repair - implications for carcinogenesis and risk assessment; Gaithersburg, MD, USA (3 Jun 1985).

DNA-protein complexes (DPCs) are composed of both normal and abnormal associations of DNA primarily with proteins of the nuclear matrix. Although the number of fragments of DNA linked to protein increases after irradiation, the normal and radiation-induced DPCs share two characteristics, the identity of the proteins involved and the enrichment of the DNA for actively transcribing sequences. There are several implications of these central features of DPCs. First, DPC formation in irradiated cells appears to occur in a non-random fashion preferentially to regions of DNA containing active sequences at or near the nuclear matrix. DNA single-strand breaks were likewise observed to be produced preferentially in active regions of the genome. We speculate that a special environment provided by the nuclear matrix makes it an ideal region for DPC formation. Perhaps it allows accessibility of hydroxyl radicals to the DNA, because of the more open conformation of active DNA or a more highly hydrated milieu as compared to regions of the nucleus containing tightly condensed chromatin. 34 refs., 3 figs.

9913 **DNA-to-protein crosslinks and backbone breaks caused by far- and near-ultraviolet, and visible light radiations in mammalian cells.** Peak, M.J.; Peak, J.G. (Argonne National Lab., IL). pp 193-202 of Mechanisms of DNA damage and repair: Implications for carcinogenesis and risk assessment. Simic, M.G.; Grossman, L.; Upton, A.C. (eds.). New York, NY; Plenum Press (1986). (CONF-850663—). Contract W-31109-ENG-38.

From International conference on DNA damage and repair - implications for carcinogenesis and risk assessment; Gaithersburg, MD, USA (3 Jun 1985).

Spectral responses for DNA damages caused by far-uv, near-uv, and visible light radiations have been studied. The near congruence of the spectra for far-uv damages and the spectrum of DNA is good evidence that the mechanism is the same for the induction of breaks, crosslinks, and pyrimidine dimers. For near-uv, the different spectra imply that at least several nonDNA sensitizer molecules act as primary chromophores, but that DNA damage eventually results. With the understanding that near-uv and visible radiations produce a variety of chemically potent reactive oxygen species within the cell, we recognize the possibility for many types of DNA damage. If we assume that SSBs and DNA-to-protein crosslinks are random single events along the genome, it is possible to compute the number of events per cell genome per lethal event caused by the different energies used. In the near-uv and visible region, many more breaks and crosslinks are formed per lethal event than by far-uv. About 20 times more SSBs per lethal event are caused by 365-nm radiation than by x-rays, strong evidence that these breaks are effectively repaired. It is therefore likely that SSBs are not a serious event with regard to cellular lethality. The role of crosslinks and their repair in lethal events is less clear. The lack of any correlation at all between the action spectra for SSBs, or crosslinks, and lethality and mutagenesis in the same cells is evidence that another lesion or lesions are involved in these events. The multitude of chemical events that can be caused in cellular metabolites by the reactive species generated by these long wavelengths of radiation means that death is attributable to the total spectrum of changed chemicals delivered by a lethal dose, only some of which are DNA changes leading to SSBs and crosslinks. 43 refs., 3 figs., 2 tabs.

5603 Chemicals Metabolism And Toxicology

REFER ALSO TO CITATION(S) 8773, 9475, 9476, 9478, 9525, 9526, 9534, 9538, 9543, 9544, 9885, 9892, 9896

9914 **(CEA-R—5403) Analysis of mutagenic and carcinogenic risks: nitrates, nitrites, N-Nitroso compounds. Comparison with radioactive risks.** Bittel, R. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Inst. de Protection et de Surete Nucleaire). Jul 1987. 174p. (In French). NTIS (US Sales Only), PC A08/MF A01. Order Number DE88751573/JAW.

This report comes within the scope of the general studies on mutagenic and carcinogenic agents other than ionizing radiations. Through feeding, way of life and working activities, man is exposed to genotoxic risks of N-nitroso compounds (NNC). In spite of differences in the molecular modes of action, there exists some analogy between the effects of radiation exposures and those of NNC: DNA is the target in either instance. Unlike radiations, NNC are alkylating agents. The whole activation process of carcinogens arises from mechanisms leading to DNA repair.

9915 **(CONF-871075—25) Protecting subcontractor personnel during hazardous waste site characterization.** Lankford, B.R. (Oak Ridge National Lab., TN (USA)). 1987. Contract AC05-84OR21400. 13p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88001728/JAW.

From 3. Oak Ridge model conference on waste problems; Oak Ridge, TN, USA (13 Oct 1987).

This paper covers Industrial Hygiene involvement in the Site Characterization Program, focusing on the field oversight responsibilities. It discusses the different types and levels of protective equipment, gives an example of the type of situation that can arise from field characterization efforts, and gives a brief summary of health protection program elements. 3 figs., 3 tabs.

9916 **(CONF-8706206—1) Cadmium and postmenopausal bone loss.** Bhattacharyya, M.H.; Whelton, B.D.; Stern, P.H.; Peterson, D.P.; Moretti, E.S.; Dare, H.A. (Argonne National Lab., IL (USA); Eastern Washington Univ., Cheney (USA). Dept. of Chemistry; Northwestern Univ., Chicago, IL (USA). Dept. of Pharmacology). 1987. Contract W-31109-ENG-38. 4p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88003065/JAW.

From Department of Energy contractor's meeting on chemical toxicity; Monterey, CA, USA (23 Jun 1987).

Neither ovariectomy alone nor dietary cadmium exposure alone caused statistically significant decreases in the mean calcium contents and calcium/dry weight ratios of the femurs and lumbar vertebrae. Exposure to 50 ppM dietary Cd caused a significant increase in the loss of bone calcium after ovariectomy such that the calcium contents and calcium to dry weight ratios of both femurs and lumbar vertebrae were strikingly lower than those of all other groups.

9917 **(CONF-8706206—2) Lactation-induced cadmium-binding proteins.** Bhattacharyya, M.H.; Solaiman, D.; Garvey, J.S.; Miyazaki, W.Y. (Argonne National Lab., IL (USA); Duquesne Univ. of the Holy Ghost, Pittsburgh, PA (USA). Dept. of Chemistry; Syracuse Univ., NY (USA). Dept. of Biology). 1987. Contract W-31109-ENG-38. 3p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88002617/JAW.

From Department of Energy contractor's meeting on chemical toxicity; Monterey, CA, USA (23 Jun 1987).

Previously we have demonstrated an increase during midlactation in ^{109}Cd adsorption and increased retention by the duodenum, kidney, and mammary tissue of mouse dams receiving environmental levels of cadmium/^{109}Cd via drinking water, with little change in ^{109}Cd retention in liver and jejunum compared to nonpregnant controls. Results are reported here of a study of cadmium deposition during midlactation as associated with induction of metallothionein (MT). A cadmium/hemoglobin (Cd/Hb) assay and radioimmunoassay for MT which measures heat-stable cadmium binding capacity in tissues was used to determine MT concentrations in fractions of kidney, liver, duodenum, and jejunum from female mice. Both assays demonstrated clear lactation-induced increases in MT concentrations in liver, kidney, and duodenum, with MT concentrations falling rapidly to control levels after weaning. 4 refs., 1 tab.

9918 **(CONF-8710199—1) Comparison of human exposure to dioxin from municipal waste incineration and background environmental contamination.** Hattemer-Frey, H.A.; Travis, C.C. (Oak Ridge National Lab., TN (USA)). 1987. Contract AC05-84OR21400. 11p. NTIS, PC A03/MF A01; GPO Dep. Order Number DE88002314/JAW.

From Dioxin '87; Las Vegas, NV, USA (4 Oct 1987).

This paper characterizes the pathways and extent of human exposure to dioxin. The long-term, average daily intake of dioxin is

estimated to be 0.05 ng/day. Results show that the food chain is the major source of human exposure to dioxin, while municipal waste incineration is not a principal source of human exposure. 33 refs., 3 tabs.

9919 **(DGMK—174-9) Effects of isoparaffins on man and animals.** Deutsch-Wenzel, R.P.; Herrmann, H.; Jungen, H.; Meinecke, M.; Taeuber, U. (Deutsche Wissenschaftliche Gesellschaft fuer Erdoel, Erdgas und Kohle e.V., Hamburg (Germany, F.R.)). Feb 1987. 180p. (In German). Deutsche Wissenschaftliche Gesellschaft fuer Erdoel, Erdgas und Kohle e.V., Hamburg, Germany, F.R.

In petrochemistry the term 'isoparaffins' is applied to all branched chain alkanes. This report, however, relates only to C/sub 6/-C/sub 12/ isoparaffins. C/sub 6/-C/sub 12/ isoparaffins are colorless, flammable liquids with a faint, but characteristic odor. Their volatility decreases with increasing carbon content. The vapors of C sub(6/sup +/) isoparaffins are heavier than air and can form explosive mixtures with air. They burn in the presence of oxygen forming carbon dioxide and water. Like all paraffins, isoparaffins are of low reactivity. They are found in crude oil and petroleum products, especially in motor gasoline and special boiling point solvents. The occurrence of isoparaffins in the environment is chiefly due to anthropogenous emissions produced by motor vehicles whereas emissions from oil-fired plants are low. Total emissions of isoparaffins from the aforementioned sources have been estimated for the Federal Republic of Germany to amount to approximately 44 000 tons per year (1985). Not included in this total are emissions from solvent use due to the lack of suitable data. The human organism can be exposed to isoparaffins either at the workplace or in the environment. It is assumed that inhalation of isoparaffin vapors and their absorption via the lungs is the major route of uptake. Pulmonary retention data are only available for 2-methylpentane and 3-methylpentane (15-18%). They are almost identical with those for n-hexane. Direct skin contact with liquid isoparaffins or mixtures containing isoparaffins may lead to percutaneous uptake. The absorption rate measured was 0.11 μg/cm/sup 2//h for 2-methylpentane in the rat and is expected to be lower in man. The uptake of isoparaffin vapors through the skin is probably of no importance. With 35 tabs..

9920 (INIS-mf—11048, pp 21) **X-ray functional study of external respiration at acute organic phosphorus compounds poisoning.** Ganchev, D. Oct 1985. (In Bulgarian). NTIS (US Sales Only), PC A09/MF A01. Order Number DE88780035/JAW. (CONF-8510479—).

From 6. national congress of roentgenology, radiology and radiobiology; Sofia, Bulgaria (4 Oct 1985).

9921 **(KFK-PEF—12-Vol.1) 3. PEF status colloquium Karlsruhe, March 10-12, 1987.** Horsch, F.; Filby, W.G.; Fund, N.; Gross, S.; Hanisch, B.; Kilz, E.; Seidel, A. (comps.). (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Projekt Europaeisches Forschungszentrum fuer Massnahmen zur Luftre). Apr 1987. 345p. (In German). (CONF-8703151—Vol.1). NTIS (US Sales Only), PC A15/MF A01. Order Number DE88750533/JAW.

From 3. PEF status colloquium of Kernforschungszentrum Karlsruhe G.m.b.H.; Karlsruhe, F.R. Germany (10 Mar 1987).

During March 10-12, 1987, the 3. status colloquium of the project 'European Research Centre for Air Pollution Control Measures' took place at Karlsruhe. Progress reports on the following topics were presented: Assessment and analysis of the impacts of airborne pollutants on forest trees; distinction from other potential causes of recent forest dieback. Separate abstracts were prepared for 32 papers in this report.

9922 (KFK-PEF—12-Vol.1, pp 1-12) **Ecophysiological measurements at fumigated forest seedlings.** Schweizer, B.; Arndt, U. (Hohenheim Univ., Stuttgart, Germany, F.R. Inst. fuer Landeskultur und Pflanzenoekologie). Apr 1987. (In German). NTIS (US Sales Only), PC A15/MF A01. Order Number DE88750533/JAW. (CONF-8703151—Vol.1).

From 3. PEF status colloquium of Kernforschungszentrum Karlsruhe G.m.b.H.; Karlsruhe, F.R. Germany (10 Mar 1987).

The main emphasis of the measurements during the vegetation period 1986 was put on the determination of CO/sub 2//H/sub 2/O-gas exchange of silver firs, spruces and beeches, which are fumigated in open-top-chambers single or in combination with realistic concentrations of O/sub 3/, SO/sub 2/ and simulated acid rain (pH 4) since 3 years. These experiments are performed with the so-called 'minicuvette-system' to determine net photosynthesis and transpiration as dependent on light intensity under standardized conditions of temperature and humidity. The fumigated beech-trees showed a reduced netphotosynthesis-rate, where the differences compared to the control plants were to be registered as dependent on the pollutant variant. This-year silver fir needles showed also a reduced assimilation rate under combined fumigation with O/sub 3/ and SO/sub 2/, the light saturation curves, however, determined on experimental trees, each fumigated with O/sub 3/ and SO/sub 2/ respectively, as also on control plants showed approximately the same course. Similar results are given for the investigated spruce-trees.

9923 (KFK-PEF—12-Vol.1, pp 13-23) **Investigations on spruce-trees in a diseased forest area with exclusion of gaseous pollutants in open-top chambers.** Seufert, G.; Arndt, U. (Hohenheim Univ., Stuttgart, Germany, F.R. Inst. fuer Landeskultur und Pflanzenoekologie). Apr 1987. (In German). NTIS (US Sales Only), PC A15/MF A01. Order Number DE88750533/JAW. (CONF-8703151—Vol.1).

From 3. PEF status colloquium of Kernforschungszentrum Karlsruhe G.m.b.H.; Karlsruhe, F.R. Germany (10 Mar 1987).

In this project 15-years-old, naturally growing spruce-trees are kept in purified or ambient air with the help of open-top chambers, to look in an exclusion-experiment at the effects of gaseous pollutants. After 6 months measuring edaphic and climatic parameters as well as exclusion efficiency of the chambers, it is assumed, that the trees can be kept over years in this type of chamber, where the environmental conditions are identical or very similar to ambient concentrations. Until now, there have been no problems with storms, snow or frost in winter. Concerning effect research a working group was established to investigate mineral cycling, ecophysiology, plant metabolism and anatomy, whereas fields like transport or root activity are not yet covered.

9924 (KFK-PEF—12-Vol.1, pp 33-44) **Feasibility study on experiments with open-top chambers to assess the effects of various air pollutants on health and growth of forest trees.** Kenk, G.; Boehm, G.; Hungar, U. (Forstliche Versuchs- und Forschungsanstalt Baden-Wuerttemberg, Freiburg im Breisgau, Germany, F.R.). Apr 1987. (In German). NTIS (US Sales Only), PC A15/MF A01. Order Number DE88750533/JAW. (CONF-8703151—Vol.1).

From 3. PEF status colloquium of Kernforschungszentrum Karlsruhe G.m.b.H.; Karlsruhe, F.R. Germany (10 Mar 1987).

In autumn 1986 the installation of an experimental station with two open-top chambers was finished. Technical tests are in progress. Presented are: 1) Results of wind-channel experiments concerning the entering of ambient air from the open top of the chamber. 2) Measurements and procedures for harmonization of air flow within the chamber. 3) Results of detection O/sub 3/, SO/sub 2/ and NO/sub 2/ by wet chemicals. Efficiency depends heavily on test cycle. 4) Comparisons of some meteorological parameters (chamber effect). Air temperatures within the chambers are considerably higher in relation to the environment. The largest differences are stated up till now for the big chamber depending on intensity of solar radiation. The planned tests are dealing mainly with measuring chamber effects and improving details of chambers technique.

9925 (KFK-PEF—12-Vol.1, pp 87-99) **Reference data to forest growth - comparison of growth rates of actual and preceding stands.** Kenk, G. (Forstliche Versuchs- und Forschungsanstalt Baden-Wuerttemberg, Freiburg im Breisgau, Germany, F.R.). Apr 1987. (In German). NTIS (US Sales Only), PC A15/MF A01. Order Number DE88750533/JAW. (CONF-8703151—Vol.1).

From 3. PEF status colloquium of Kernforschungszentrum Karlsruhe G.m.b.H.; Karlsruhe, F.R. Germany (10 Mar 1987).

Growth and increment of forest trees and stands are visible and quantitatively measurable results of their physiological per-

formance and activity. They are in this respect of diagnostic importance. Because the conclusion from visible stress-symptoms (simplified called 'Waldschaeden') to reactions of growth is close at hand. But this anticipation do not turn out generally to be true, neither concerning quantitative dimension nor chronological development. The present project 'Reference data to forest growth' compares growth of actual and preceding stands. There is best of all expected to get hints at modification of forest ecosystem performance. Investigated are stands of Norway spruce (Picea abies Karst.) and silver fir (Abies alba Mill.) in the South of Germany (Black Forest). This region is touched heavily by the forest damage. The comparisons are based on growth data, collected by the forest research stations of the states Wuerttemberg and Baden since 1870 on permanent experimental plots. The data have been tested, processed by computers and are utilized now for comparisons. The next project step has to analyse the growth of the actual stand and to explain the results obtained.

9926 (KFK-PEF—12-Vol.1, pp 101-111) **Monitoring of air pollution effects on biological indicators in areas of forest disease in Baden-Wuerttemberg (active monitoring of vegetable bioindicators).** Pilgram, C.; Arndt, U. (Hohenheim Univ., Stuttgart, Germany, F.R. Inst. fuer Landeskultur und Pflanzenoekologie). Apr 1987. (In German). NTIS (US Sales Only), PC A15/MF A01. Order Number DE88750533/JAW. (CONF-8703151—Vol.1).

From 3. PEF status colloquium of Kernforschungszentrum Karlsruhe G.m.b.H.; Karlsruhe, F.R. Germany (10 Mar 1987).

In 1986, the last of the three exposure periods, foliar injuries at the indicator plants, caused by immissions, could be seen at all of the stations. It could be shown, that ozone is one of the most phytotoxic substances of air pollution in rural areas, which is documented in heavy damages at the ozone sensitive plants. In opposition to this the injuries at the urban stations were only slight. This might be an indication for the presence of higher concentration of ozone destroying pollutants, mainly of NO, in urban areas. The most aggravating injuries, with up to 50% of the leaf area of tobacco Bel W3, occurred at the western slope of the Black Forest. In 1986 for the first time two cultivars of hybrid poplar, one sensitive and one non sensitive for O/sub 3/, were exposed at all sites. Large reduction in growth were registrated at places with high injuries on tobacco.

9927 (KFK-PEF—12-Vol.1, pp 113-122) **Anatomy and histochemistry of conifer needles as a diagnostic tool in clarifying the participation of biotic and abiotic damaging factors in 'forest decline'.** Fink, S. (Freiburg Univ., Germany, F.R. Inst. fuer Forstbotanik und Holzbiologie). Apr 1987. (In German). NTIS (US Sales Only), PC A15/MF A01. Order Number DE88750533/JAW. (CONF-8703151—Vol.1).

From 3. PEF status colloquium of Kernforschungszentrum Karlsruhe G.m.b.H.; Karlsruhe, F.R. Germany (10 Mar 1987).

The symptoms of yellowing and flecking, discussed in connection with the 'novel forest damages', have been investigated histologically. The results were interpreted with regard to the most probable biotic or abiotic causes of origin. The special changes within the needles associated with yellowing could be explained exclusively by the widespread Mg-deficiency, without the necessity to postulate a direct damaging impact of gaseous air pollutants. A primary impact of the pollutants via the soil seems to be predominant. A causal participation of biotic pathogens (fungi, viruses) is considered improbable. Concerning the phenomenon of flecking the common interpretation as a sign of ozone-damage is questioned. Instead of this an explanation of local frost damage together with intensive insolation during winter is favored, in accordance with observations described already decades ago. Additionally a more differentiated view towards such flecks is demanded, since also biotic pests and pathogens (mites, cicades, fungi) may cause macroscopically similar flecks.

9928 (KFK-PEF—12-Vol.1, pp 123-133) **Investigations on the hormone-balance of healthy and damaged conifers in the northern Black Forest.** Frenzel, B.; Christmann, A. (Hohenheim Univ., Stuttgart, Germany, F.R. Inst. fuer Botanik). Apr 1987. (In German). NTIS (US Sales Only), PC A15/MF A01. Order Number DE88750533/JAW. (CONF-8703151—Vol.1).

From 3. PEF status colloquium of Kernforschungszentrum Karlsruhe G.m.b.H.; Karlsruhe, F.R. Germany (10 Mar 1987).

According to our working hypothesis a virus infection could be responsible for an important part of the forest decline, causing a premature, untypical senescence of the affected trees which is due to a disturbed hormone balance. The previous results show that virus-like particles (VLP) are very widely distributed in coniferous trees of southern Central Europe. Moreover, distinct disturbances occur in the balance of the so far examined hormones - ethylene and abscisic acid (AbA) - in the case of disease or a strong SO/sub 2/-impact on the site. They happen on the background of normal changes in the hormone contents which depend on season, age (age of tree, branch and needle) or exposition and which differ from each other on sites with a strong SO/sub 2/-impact and on those with a low or missing one. They show that SO/sub 2/-damage and forest decline in the examined area are two different things. The occurrence of VLP seems to disturb the ethylene balance considerably.

9929 (KFK-PEF—12-Vol.1, pp 135-148) **Seasonal changes in acid stability of the light-harvesting chlorophyll-a/b-protein complex (LHC) and properties of the photosystem II-protein. Comparison between a healthy and a damaged spruce tree growing at Kaelbelescheuer area.** Siefermann-Harms, D.; Ninnemann, H. (Tuebingen Univ., Germany, F.R. Inst. fuer Chemische Pflanzenphysiologie). Apr 1987. (In German). NTIS (US Sales Only), PC A15/MF A01. Order Number DE88750533/JAW. (CONF-8703151—Vol.1).

From 3. PEF status colloquium of Kernforschungszentrum Karlsruhe G.m.b.H.; Karlsruhe, F.R. Germany (10 Mar 1987).

Studies started in 1985 on spruce trees in Southern Black Forest, FRG, were continued. A healthy control tree was compared with a damaged tree showing symptoms of photobleaching. Acid stability of the LHC increased in needles of tree no. 21 with increasing needle age. It also increased in the course of the year and reached the highest levels of stability in late fall. In early summer 1986 the needle generation of 1984 from tree no. 22 changed its colour from green to yellow. The LHC isolated from green needles at this point had lost its acid stability. In late summer 1986 the needle generation of 1985 also became yellow. Needles harvested before the start of this bleaching event contained a stable LHC. The present data are consistent with results obtained in 1985 with other trees. Cytochrome content and acid stability of the photosystem II-protein were identical for both spruce trees.

9930 (KFK-PEF—12-Vol.1, pp 149-157) **Quantitative analysis of terpenes and other VOC of needles of Picea abies of natural and differently fumigated (O/sub 3/,SO/sub 2/) open-top chamber stands.** Juettner, F. (Tuebingen Univ., Germany, F.R. Inst. fuer Chemische Pflanzenphysiologie). Apr 1987. (In German). NTIS (US Sales Only), PC A15/MF A01. Order Number DE88750533/JAW. (CONF-8703151—Vol.1).

From 3. PEF status colloquium of Kernforschungszentrum Karlsruhe G.m.b.H.; Karlsruhe, F.R. Germany (10 Mar 1987).

On a slope of the area Kaelbelescheuer (Southern Black Forest) which is characterized by the occurrence of phytotoxic air, one branch of a spruce (Picea abies) was protected by a filter from direct UV-B-irradiation. Compared with a reference branch of the same tree the yellowish discoloration of the last year needles occurred at the same time. No differences in the concentrations and patterns of monoterpenes were observed in both branches. There is no evidence that UV-B might have a positive effect on the formation of the discoloration of needles. p-Hydroxyacetophenone was found in some but not all samples of yellowish needles of damaged spruce. The concentrations of free p-hydroxyacetophenone in green needles of healthy trees were always very low. Other not yet elucidated compounds in the needles were better correlated with the stage of damage of the trees than this compound. Needles of spruce which have been fumigated in open-top chambers with ozone and/or sulphur dioxide exhibited rather similar terpene concentrations and patterns. Limonene, however, was present in nearly twice as high concentrations in fumigated autumnal needles as compared to reference needles grown in clean, charcoal treated air.

9931 (KFK-PEF—12-Vol.1, pp 159-165) **Immissions of terpenes over Picea abies stands in open-top chambers fumigated with ozone, sulphur dioxide and a mixture of both.** Juettner, F.; Bufler, U. (Tuebingen Univ., Germany, F.R. Inst. fuer Chemische Pflanzenphysiologie). Apr 1987. (In German). NTIS (US Sales Only), PC A15/MF A01. Order Number DE88750533/JAW. (CONF-8703151—Vol.1).

From 3. PEF status colloquium of Kernforschungszentrum Karlsruhe G.m.b.H.; Karlsruhe, F.R. Germany (10 Mar 1987).

The terpene immissions were measured in the air over stands of Picea abies which have been cultivated 3 years in open-top chambers with O/sub 3/-, SO/sub 2/- and O/sub 3//SO/sub 2/-enriched air. A stand fumigated with charcoal-treated air was used as the reference. Highest terpene immissions were observed for α-pinene, limonene and sabinene, medium for eucalyptol, β-pinene, camphene and myrcene, and lowest for tricyclene, camphor, γ-terpinene and bornyl acetate. A reduction of terpene immissions was found over all stands which were fumigated with noxious gases. A change of the terpene pattern that was characterized by an increase of the limonene concentration was observed after a one-week dry period in the O/sub 3/- and O/sub 3//SO/sub 2/-chamber. After sprinkling, the terpene immissions generally increased. Under these conditions, exceptionally high concentrations of sabinene were observed over O/sub 3/-treated stands of Picea abies.

9932 (KFK-PEF—12-Vol.1, pp 167-176) **Carbohydrates and pyridine nucleotides in healthy and diseased needles: Alterations in relation to vegetation period (May to October 1985) and needle age (1979 to 1985).** Keil, R.; Einig, W.; Hampp, R. (Tuebingen Univ., Germany, F.R. Inst. fuer Biologie 1). Apr 1987. (In German). NTIS (US Sales Only), PC A15/MF A01. Order Number DE88750533/JAW. (CONF-8703151—Vol.1).

From 3. PEF status colloquium of Kernforschungszentrum Karlsruhe G.m.b.H.; Karlsruhe, F.R. Germany (10 Mar 1987).

Lyophilized spruce needles (Picea abies; location: Kaelbelescheuer, southern Black Forest) were analyzed for carbohydrates (starch, sucrose, fructose, glucose) and reduced (NADH, NADPH) as well as oxidized (NAD, NADP) pyridine nucleotides in relation to needle age, vegetation period, and the degree of damage (level of disease classified as 0 and 3). Samples were taken from all distinct parts of a twig and analyzed separately as the levels of metabolites largely depended on the respective position of the needles. The content of starch clearly depended on the vegetation period. Based on dry weight, its level was lower in needles from the diseased tree. In contrast, the amount of sucrose did not show larger variations during the summer period nor was there any significant correlation to the degree of damage. Except for the youngest needles, we only found very low levels of glucose and fructose. These, however, were generally higher in diseased needles. Similarly, the redox levels of both pyridine nucleotide systems (NADH/NADH; NADPH/NADP) in needles from the damaged tree were increased. Together with the higher ATP/ADP ratios reported earlier for the same samples, this parameter could be indicative for metabolic processes involved in cellular desintegration.

9933 (KFK-PEF—12-Vol.1, pp 177-188) **Lipid peroxidation: A phytotoxic consequence of air pollutants.** Kunert, K.J.; Hofer, G. (Konstanz Univ., Germany, F.R. Lehrstuhl fuer Physiologie und Biochemie der Pflanzen). Apr 1987. (In German). NTIS (US Sales Only), PC A15/MF A01. Order Number DE88750533/JAW. (CONF-8703151—Vol.1).

From 3. PEF status colloquium of Kernforschungszentrum Karlsruhe G.m.b.H.; Karlsruhe, F.R. Germany (10 Mar 1987).

In a long-term investigation needles of fir and spruce and leaves of beech were exposed to SO/sub 2/ (0,03 mg/m/sup 3/ air), ozone (0,14 mg/m/sup 3/ air) and a combination of both gases in open-top chambers, and were analyzed for their content of antioxidants (vitamin C and E, glutathione). The treatments with SO/sub 2/ and the combination of pollutants showed a marked increase of the glutathione and vitamin E content in all tree species compared to the control, which was treated with purified air. The ozone treatment exhibited no or little influence. There was a strong increase in activity of the enzyme glutathione reductase (GR) in needles of fir and spruce, whereas in leaves of beech no increase could be detected. In field studies with spruce in the Black Forest and in the Swabian-Frankian forest no increase of antioxidants could be observed in relation to the visible damage of the trees. The findings suggest that increased production of antioxidants and elevated activity of antioxidative enzymes is a strategy to protect plants against the peroxidative action of air pollutants. Accordingly, glutathione- and vitamin-E contents of plants could be used as early biochemical indicators for peroxidative action of air pollutants before visible damage can be observed.

9934 (KFK-PEF—12-Vol.1, pp 189-200) **Microorganisms as biological indicators for air pollution.** Waldner-Sander, S.; Botzenhart, K. (Tuebingen Univ., Germany, F.R. Abt. fuer Allgemeine Hygiene und Umwelthygiene). Apr 1987. (In German). NTIS (US Sales Only), PC A15/MF A01. Order Number DE88750533/JAW. (CONF-8703151—Vol.1).

From 3. PEF status colloquium of Kernforschungszentrum Karlsruhe G.m.b.H.; Karlsruhe, F.R. Germany (10 Mar 1987).

Pro- and eucaryontic microorganisms were exposed to the open air in an air-borne state to indicate the presence of toxic air pollutants. To date, clear correlation has not been observed between the death rates, which describe the influence of noxious agents, and the concentrations of given pollutants (SO/sub 2/, NO/sub x/ and O/sub 3/) likely to occur outdoors. The germs are suited to detect the noxious effects of the sum of gaseous compounds in the environment, however it seems, that especially photooxidants reveal a damaging effect on metabolism. A comparison of outdoor experiments between a given site in a forest area and sites in the open field revealed changes in the death rates, which may be due to toxic compounds, resulting from the reaction of biogenous and anthropogenous pollutants. The germ flora spectrum on the surface of needles from spruce trees (Picea abies) was examined in the areas of forest damages near Kaelbelescheuer and Edelmannshof. A different density of microbial population could be detected on the age-groups of needles within every tree. Single yeasts, bacillus species and moulds could be isolated nearly the whole year. Otherwise the spectrum of species reflect the atmospheric conditions and the season. Increased numbers of organisms and species were obtained on spruce trees, yellowed in a high degree.

9935 (KFK-PEF—12-Vol.1, pp 201-210) **Deleterious effect of ammonia on growth and enzyme activity in pine (Pinus sylvestris L.) and mustard (Sinapis alba L.) seedlings: Preliminary results.** Mehrer, I.; Lettgen, W.; Kasemir, H. (Freiburg Univ., Germany, F.R. Inst. fuer Biologie 2). Apr 1987. (In German). NTIS (US Sales Only), PC A15/MF A01. Order Number DE88750533/JAW. (CONF-8703151—Vol.1).

From 3. PEF status colloquium of Kernforschungszentrum Karlsruhe G.m.b.H.; Karlsruhe, F.R. Germany (10 Mar 1987).

This study is concerned with the analysis of toxicity of ammonia with respect to seedlings. Low concentrations (a few mM, probably comparable to field situations) gave rise to symptoms of poisoning which were quantified by measuring of morphological parameters (hypocotyl length, distortion factor) and determinations of enzyme activities (GPD, RuBPCase, NR, NIR). The inhibition of RuBPCase can be detected at the level of translatable mRNA (SSU). It is concluded that the normal gene expression is impaired by ammonia. Our additional investigations on the NH/sub 4/-detoxificating enzyme GDH suggest that young seedlings have no effective protecting mechanism against ammonium levels of the above order of magnitude.

9936 (KFK-PEF—12-Vol.1, pp 323-332) **Structural studies of the cell walls in wood of diseased conifers to assess wood quality.** Fengel, D. (Muenchen Univ., Germany, F.R. Inst. fuer Holzforschung). Apr 1987. (In German). NTIS (US Sales Only), PC A15/MF A01. Order Number DE88750533/JAW. (CONF-8703151—Vol.1).

From 3. PEF status colloquium of Kernforschungszentrum Karlsruhe G.m.b.H.; Karlsruhe, F.R. Germany (10 Mar 1987).

The wood of various areas across the trunk from six firs with varying degrees of needle loss originating from a single site were studied by electron microscopic and chemical methods. Growth anomalies within the annual rings were observed in the scanning electron microscope. The study of the acetone and the

dioxane extracts did not result in changes of the soluble cell wall components related to the damage class of the trees; neither were variations in the molecular structure of the soluble lignin found by infrared spectroscopy.

9937 (KFK-PEF—12-Vol.1, pp 333-345) **Atmospheric and geogenic components of the heavy metal budget of forest trees.** Trueby, P.; Zoettl, H.W. (Freiburg Univ., Germany, F.R. Inst. fuer Bodenkunde und Waldernaehrungslehre). Apr 1987. (In German). NTIS (US Sales Only), PC A15/MF A01. Order Number DE88750533/JAW. (CONF-8703151—Vol.1).

From 3. PEF status colloquium of Kernforschungszentrum Karlsruhe G.m.b.H.; Karlsruhe, F.R. Germany (10 Mar 1987).

At geogenically respectively atmospherically heavily polluted sites the distribution of heavy metals in forest trees is investigated. Research is aimed at recognizing pathways of uptake and transport of heavy metals and at estimating the corresponding turnover rates. A contamination free preparation method of wood samples with special tools and a method to determine exchangeable heavy metals in soil is described. Preliminary data on the distribution of zinc, cadmium, lead, and arsenic are presented. Zinc as a nutrient element is accumulated in bast and foliage bat, far less in wood. Cadmium distribution is similar. But wood contains considerable amounts of cadmium related to soil supply. Lead is deposited at the outer bark in correlation to the atmospheric load. But considerable amounts of lead reach the wood via roots. Arsenic is taken up from the soil and is transported preferably to current tissue in the upper crown area.

9938 **(KFK-PEF—16) Fine structure and differentiation of the phloem of beeches, spruces and firs from areas affected by forest dieback in South Germany.** Schulz, A.; Behnke, H.D. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Projekt Europaeisches Forschungszentrum fuer Massnahmen zur Luftre). May 1987. 102p. (In German). NTIS (US Sales Only), PC A06/MF A01. Order Number DE88750532/JAW.

Organisation, development and structure of the phloem of beeches, spruces and firs from areas affected by forest dieback in Southwestern Germany were studied. Special emphasis was laid on changes occurring during the regular ultrastructural differentiation of sieve elements in contrast to artifacts produced by preparation influences. The structural data obtained during the years 1984 and 1985 are intended as a standard for a comparison to studies of later years. - Neither specific P-protein modifications in sieve elements of beeches nor peculiar structures within albuminous cells of the conifers can be interpreted as direct or indirect results of infections with MLO, RLB or viruses. Virualike particles have been demonstrated in situ in parenchyma cells of one fir, only. - This summary is based on 750 (350) samples from 42 trees located in the Odenwald and Black Forest and investigated by fluorescence (resp. electron) microscopy.

9939 **(RFP—4114) Application technology health effects program progress report, January 1986-December 1986.** Smith, L.C.; Deitesfeld, C.A. (ed.). (Rockwell International Corp., Golden, CO (USA). Rocky Flats Plant). 2 Aug 1987. Contract AC04-76DP03533. 11p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE87014624/JAW.

Individual projects are processed separately for the data base. Included are methods for detecting antibodies to beryllium, the procedure for a toxicity assay, and a list of materials tested for their toxicity. (TEM)

9940 (RFP—4114, pp 1-3) **Beryllium antibody detection method.** Clarke, S.M.; Barrick, C.W. 2 Aug 1987. NTIS, PC A02/MF A01. Order Number DE87014624/JAW.

In Application technology health effects program progress report, January 1986-December 1986.

This report describes improvements in an enzyme-linked, immunosorbent assay that will detect antibodies against beryllium. 2 refs., 1 tab. (TEM)

9941 (RFP—4114, pp 3-6) **Characterization of the in vitro human erythrocyte acute toxicity assay.** Clarke, S.M.; Barrick, C.W. 2 Aug 1987. NTIS, PC A02/MF A01. Order Number DE87014624/JAW.

In Application technology health effects program progress report, January 1986-December 1986.

This report describes procedures used in an in vitro acute toxicity assay that uses human erythrocyte ATP and a bioluminescent detection system. To test for possible false reactions, alternate reagents were substituted individually: no false positive tests occurred. 5 figs. (TEM)

9942 (RFP—4114, pp 6-7) **Testing of the in vitro human erythrocyte acute toxicity assay.** Clarke, S.M.; Barrick, C.W. 2 Aug 1987. NTIS, PC A02/MF A01. Order Number DE87014624/JAW.

In Application technology health effects program progress report, January 1986-December 1986.

This report describes testing of an in vitro acute toxicity assay. Nine toxic substances, mostly metals, were tested; aluminum, iron, lead, and beryllium proved to be toxic. 1 ref., 3 figs. (TEM)

9943 **Stereoselective covalent binding of enantiomers of anti-benzo[a]pyrene diol epoxide DNA as probed by optical detection of magnetic resonance.** Kolubayev, V.; Brenner, H.C.; Geacintov, N.E. (New York Univ., NY). *Biochemistry;* **26**: No. 9, 2638-2641(5 May 1987). Contract FG02-86ER60405.

Phosphorescence and optical detection of magnetic resonance measurements applied to the covalent adducts of (+)- and (-)-anti-benzo[a]pyrene with DNA show a marked red shift of the pyrenyl phosphorescence and a lowering of the zero field splitting parameters of the (-) adduct, relative to the (+) adduct and the (solvent-exposed) benzo[a]pyrene tetraol. These results are consistent with a predominance of quasi-intercalative sites in the (-) adduct and external, solvent-exposed sites in the (+) adduct.

9944 **Comparative cytogenetic analysis of bone marrow damage induced in male B6C3F1 mice by multiple exposures to gaseous 1,3-butadiene.** Tice, R.R.; Boucher, R.; Luke, C.A.; Shelby, M.D. (Brookhaven National Lab., Upton, NY). *Environmental Mutagenesis;* **9**: No. 3, 235-250(1987). Contract AC02-76CH00016.

Groups of male B6C3F1 mice were exposed to ambient air or to gaseous 1,3-butadiene (BD) at 6.25, 62.5, and 625 ppm for 10 exposure days. Exposure to BD induced in bone marrow: 1) a significant increase in the frequency of chromosomal aberrations (CA); 2) a significant elevation in the frequency of sister chromatid exchanges (SCE); 3) a significant lengthening of the average generation time (AGT); 4) a significant depression in the mitotic index (MI): and, as measured in the peripheral blood, 5) a significant increase in the proportion of circulating polychromatic erythrocytes (% PCE), and 6) a significant increase in the level of micronucleated PCE (MN-PCE) and micronucleated normochromatic erythrocytes (MN-NCE). The most sensitive indicator of genotoxic damage was the frequency of SCE, followed by MN-PCE levels, and then by CA and MN-NCE frequencies. The most sensitive measure of cytotoxic damage was AGT followed by % PCE and then my MI. The extent of concordance ranged from a very good correlation between the induction of MN-PCE and the induction of SCE to the lack of a significant correlation between the depression in the MI and any other endpoint.

9945 **Linking laboratory and field of fish populations to acidification.** Winkle, W.V.; Christensen, S.W.; Breck, J.E. (Oak Ridge National Lab., TN). *Water, Air, and Soil Pollution;* **30**: No. 3-4, 639-648(1986).

To increase understanding of mechanisms by which fish populations respond to water chemistry changes resulting from acidification, it is necessary to link the results of laboratory studies of the effects of pH, Al, and Ca on the survival, growth, and reproduction of individual fish to responses of fish populations in the field. Our framework for achieving this goal is based on the types of data commonly available from both laboratory and field studies. One of the models (PHALCA) in this framework estimates the number of

fish surviving as a function of time, given pH, Al, and Ca levels. A second model (FISHEGGS) evaluates the reduction in reproductive potential of a fish population attributable to the effects of pH, Al, and Ca on the survival of young-of-the-year and older fish and on fecundity. Preliminary results from these two models are presented, and the entire framework will be applied and tested over the next year using data for brook trout and lakes in the Adirondacks. The framework and models are a complementary alternative to the statistical analysis of survey data on water chemistry and on presence or absence of a fish species.

9946 **Sequence specificity and biological consequences of drugs that bind covalently in the minor groove of DNA.** Hurley, L.H.; Needham-VanDevanter, D.R. (Univ. of Texas, Austin). pp 203-210 of Mechanisms of DNA damage and repair: Implications for carcinogenesis and risk assessment. Simic, M.G.; Grossman, L.; Upton, A.C. (eds.). New York, NY; Plenum Press (1986). (CONF-850663—).

From International conference on DNA damage and repair - implications for carcinogenesis and risk assessment; Gaithersburg, MD, USA (3 Jun 1985).

DNA ligands which bind within the minor groove of DNA exhibit varying degrees of sequence selectivity. Factors which contribute to nucleotide sequence recognition by minor groove ligands have been extensively investigated. Electrostatic interactions, ligand and DNA dehydration energies, hydrophobic interactions and steric factors all play significant roles in sequence selectivity in the minor groove. Interestingly, ligand recognition of nucleotide sequence in the minor groove does not involve significant hydrogen bonding. This is in sharp contrast to cellular enzyme and protein recognition of nucleotide sequence, which is achieved in the major groove via specific hydrogen bond formation between individual bases and the ligand. The ability to read nucleotide sequence via hydrogen bonding allows precise binding of proteins to specific DNA sequences. Minor groove ligands examined to date exhibit a much lower sequence specificity, generally binding to a subset of possible sequences, rather than a single sequence. 19 refs., 7 figs.

9947 **DNA binding and biological properties of bis- and tris-intercalating molecules.** Le Pecq, J.B.; Roques, B.P. (Institut Gustave Roussy, Villejuif, France; Universite Rene Descartes, Paris, France). pp 219-230 of Mechanisms of DNA damage and repair: Implications for carcinogenesis and risk assessment. Simic, M.G.; Grossman, L.; Upton, A.C. (eds.). New York, NY; Plenum Press (1986). (CONF-850663—).

From International conference on DNA damage and repair - implications for carcinogenesis and risk assessment; Gaithersburg, MD, USA (3 Jun 1985).

Many small organic molecules able to reversibly bind to nucleic acids have been discovered, many of which have also been found to be mutagenic. However, the binding constant for DNA of these molecules is much smaller than that of the natural DNA binding proteins. It might be of interest to design simple molecules capable of binding to DNA with an affinity constant higher than 10^{10} M^{-1}. Such molecules might be able to compete in vivo with the DNA binding proteins which regulate genetic expression, and might be endowed with interesting biological properties. In this paper, the strategy which was used to design molecules able to bind to double stranded nucleic acids with high affinity is described. This strategy takes advantage of the characteristics of the DNA intercalation process and of the properties of oligomeric ligands. The properties of bis- and tris-intercalating molecules will be discussed. Because several antitumor agents were discovered among DNA bisintercalating molecules, the studies dealing with the mechanism of action of these compounds in relation to their DNA binding properties will also be reviewed. 53 refs., 5 figs.

9948 **Computer-aided design of new DNA intercalators.** Neidle, S. (Institute of Cancer Research, Sutton, United Kingdom). pp 257-264 of Mechanisms of DNA damage and repair: Implications for carcinogenesis and risk assessment. Simic, M.G.; Grossman, L.; Upton, A.C. (eds.). New York, NY; Plenum Press (1986). (CONF-850663—).

From International conference on DNA damage and repair - implications for carcinogenesis and risk assessment; Gaithersburg, MD, USA (3 Jun 1985).

Many anti-neoplastic agents directly interact with DNA. Interference with processes of DNA transcription, replication, RNA synthesis and topoisomerase action, as well as mutagenicity, have been variously noted for these agents; the precise mechanisms whereby they have a differential effect on tumor cells remain unclear, although their differential effect on rapidly-proliferating cells is an important factor. In the absence of such evidence, approaches to the development of new DNA-reactive anti-cancer drugs remain semi-empirical, although their clinical need is of very considerable importance on account of both the narrow spectrum of activity and narrow therapeutic index of current drugs. Doxorubicin has proven activity against a wider range of human tumors than any other drug, yet its applicability is often inhibited by severe dose-related cumulative cardio-toxicity. The origins of this have not been unequivocally elucidated, but the weight of evidence points to the involvement of lipid peroxidation mechanisms. There has been intensive effort to circumvent this problem, while maintaining or even improving the range of tumor conditions that are treatable. These have resulted on the one hand in new anthracycline analogues such as 4'-epidoxorubicin, and on the other in anthraquinones that have radically simpler chemistry. Mitoxanthrone is the first such compound to have progressed through clinical trial into usage. The development of new DNA-interactive compounds has been given added impetus by the realization that DNA-binding is a necessary and critical factor that correlates with inhibition of cell growth in culture and even anti-tumor activity in vivo. This paper describes an approach to the rational design of such compounds that attempts to optimize DNA-intercalative factors. 18 refs., 5 figs., 1 tab.

9949 **Salmonella tester strains: Mutational targets and correlation with animal carcinogenicity and teratogenicity.** Hartman, P.E.; Aukerman, S.L. (Johns Hopkins Univ., Baltimore, MD). pp 407-424 of Mechanisms of DNA damage and repair: Implications for carcinogenesis and risk assessment. Simic, M.G.; Grossman, L.; Upton, A.C. (eds.). New York, NY; Plenum Press (1986). (CONF-850663—).

From International conference on DNA damage and repair - implications for carcinogenesis and risk assessment; Gaithersburg, MD, USA (3 Jun 1985).

The Salmonella mutagen tester strains are sometimes spoken of as if they were part of the fossil record. In fact, there has been continual development of the strains, and development continues today. Salmonella histidine-requiring mutants were first used to assay for mutagenicity of cycasin aglycone, a naturally occurring carcinogen and methylating agent, and to determine that covalent linkage to DNA produced much stronger frameshift mutagenesis than did mere intercalation or stacking. Particular histidine-requiring mutants were carefully selected from among over 1000 characterized mutants in searches for those with conveniently low background levels of spontaneous mutability and optimal responses to particular known mutagens. Examples are the response of hisG46 to a methylating agent and the response of hisD3052 to a variety of frameshift mutagens. The Ames group sequentially developed derivatives that were lacking in complete cell walls (gal, rfa) and thus more penetrable by some mutagens, defective in the uvr system of DNA repair, a repair system active on pyrimidine dimers and other helix-distorting lesions, and containing plasmid pKM101 that sensitizes the bacteria to DNA interstrand cross-linking agents. The molecular activity of the genes (mucA, mucB) on pKM101 active in enhancing mutagenesis is only partially understood. Plasmid pKM101 may allow apurinic and apyrimidinic sites to be much more mutagenic than would be the case in its absence. Strains containing pKM101 are more mutagen sensitive, have high spontaneous backgrounds, and differentiate base substitution and frameshift mutagens less well than do their plasmidless counterparts. The addition of microsomal extract to activate promutagens was a critical innovation. 109 refs., 7 figs., 3 tabs.

9950 **Use of gradient denaturing gels to determine mutational spectrum in human cells.** Cariello, N.F.; Thilly, W.G. (Massachusetts Institute of Technology, Cambridge). pp 439-452 of Mechanisms of DNA damage and repair: Implications for carcinogenesis and risk assessment. Simic, M.G.; Grossman, L.; Upton, A.C. (eds.). New York, NY; Plenum Press (1986). (CONF-850663—).

From International conference on DNA damage and repair - implications for carcinogenesis and risk assessment; Gaithersburg, MD, USA (3 Jun 1985).

Based on the fact that mutagens induce specific patterns of gene mutations, this paper outlines a method to allow discrimination among mutagen-treated populations. The technique should allow direct screening of human tissue for genetic change, using human peripheral blood lymphocytes deficient in the enzyme hypoxanthine guanine phosphoribosyl transferase. The method is based on gradient denaturing gel electrophoresis, which separates short DNA molecules according to their melting properties. The melting behavior of DNA fragments is extremely sequence-dependent, and DNAs with single basepair substitutions often migrate differently. Even DNA fragments with the same basepair substitutions at different locations in the molecule have been resolved. Gradient-denaturing gel electrophoresis has the capacity to separate mutant DNA on the basis of the nature and position of the mutation. 17 refs., 11 figs.

9951 **Urinary N-nitrosamino acids as indices of endogenous formation of N-nitroso compounds.** Oshima, H.; Pignatelli, B.; Nair, J.; Munoz, N.; Calmels, S.; Crespi, M.; Lu, S.H.; Bhide, S.V.; Vincent, P.; Leclerc, H. (International Agency for Research on Cancer, Lyon, France; Regina Elena Institute for the Study and Therapy of Tumors, Rome, Italy; Chinese Academy of Medical Sciences, Beijing, People's Republic of China; Tata Memorial Center, Bombay, India; Universite Claude Bernard, Lyon, France). pp 453-461 of Mechanisms of DNA damage and repair: Implications for carcinogenesis and risk assessment. Simic, M.G.; Grossman, L.; Upton, A.C. (eds.). New York, NY; Plenum Press (1986). (CONF-850663—).

From International conference on DNA damage and repair - implications for carcinogenesis and risk assessment; Gaithersburg, MD, USA (3 Jun 1985).

Exposure to their precursors (e.g., amines, nitrate/nitrite, NO/sub x/) can lead to formation in the human body of N-nitroso compounds (NOC), a class of potent animal carcinogens, which are also suspected of being carcinogenic in man. A non-invasive method, the 'N-nitrosoproline (NPRO) test,' for estimating endogenous nitrosation in man was developed in our laboratory. This test, which monitors 24-hr-excretion of urinary N-nitrosamino acids, is now applied in clinical and field studies, with the aim of measuring nitrosamine exposure and of identifying dietary, life-style, and host factors, or disease states, that affect nitrosation in man. Results from such studies are used to identify populations/individuals at high risk for cancers of the stomach, esophagus, and oral cavity possibly caused by endogenous nitrosamines, and to indicate preventive measures by which the body burden of endogenous nitroso carcinogens can be lowered efficiently. 31 refs., 1 fig., 1 tab.

9952 **Application of monoclonal antibodies to monitor human exposure to aflatoxin B1.** Groopman, J.D. (Boston Univ. School of Public Health, MA). pp 463-471 of Mechanisms of DNA damage and repair: Implications for carcinogenesis and risk assessment. Simic, M.G.; Grossman, L.; Upton, A.C. (eds.). New York, NY; Plenum Press (1986). (CONF-850663—).

From International conference on DNA damage and repair - implications for carcinogenesis and risk assessment; Gaithersburg, MD, USA (3 Jun 1985).

We have been applying monoclonal antibody technology to produce antibodies which recognize aflatoxins. These antibodies are being used in conjunction with other chemical analytic techniques to develop non-invasive screening methodologies for monitoring human exposure to environmentally occurring carcinogens. These screening methods require the ability to quantify aflatoxin and its metabolites, including DNA adducts, in readily accessible compartments such as serum and urine. Another important requirement of these procedures is that they have to be rapid enough to measure many samples in a short period of time. Earlier measurements of aflatoxin metabolites, including the DNA adducts, have used techniques such as thin layer chromatography, high performance liquid chromatography, and immunological assays to prepare and analyze aflatoxin-containing samples. However, a fundamental disadvantage of many of these procedures was the lengthy preparation time required before the sample could be submitted to analytical analysis. We consider our new methods to be rapid enough (less than one hour) to be applied to large-scale epidemiological studies to measure aflatoxin exposure in populations. Furthermore, these methods permit the resolution by HPLC of aflatoxin mixtures into their individual components. These components, such as the DNA adducts, can be submitted to chemical procedures to enhance the ultimate sensitivity of the analysis. Taken together, it now appears that a combination of monoclonal antibody technology and analytical chemistry is providing a rapid and sensitive means for the initiation of epidemiologic pilot studies to assess the exposure status of populations to the environmentally occurring carcinogen aflatoxin B1. 14 refs., 6 figs.

9953 **Blood proteins as carcinogen dosimeters.** Tannenbaum, S.R.; Skipper, P.L. (Massachusetts Institute of Technology, Cambridge). pp 473-478 of Mechanisms of DNA damage and repair: Implications for carcinogenesis and risk assessment. Simic, M.G.; Grossman, L.; Upton, A.C. (eds.). New York, NY; Plenum Press (1986). (CONF-850663—).

From International conference on DNA damage and repair - implications for carcinogenesis and risk assessment; Gaithersburg, MD, USA (3 Jun 1985).

The problem of quantifying exposure to genotoxins in a given individual represents a formidable challenge. In this paper methods which rely on the covalent binding of carcinogens and their metabolites to blood proteins are described. That carcinogens interact with proteins as well as with DNA has been established, although whether protein-carcinogen adducts can result in genetic damage has not been established. It has been shown, however, that the amount of a protein carcinogen adduct formed may be used as a quantitative measure of exposure to a carcinogen. Such a measure presumably is reflective of the absorption, metabolism, and excretion of the compound in an exposed individual. Protein adduction may reflect exposure in a time-frame of weeks to months. Thus, protein adduct measurement is a form of human chemical dosimetry. Hemoglobin and albumin are promising candidates for such dosimeters. Hemoglobin has a lifetime of about 120 days in humans; thus, circulating levels of carcinogen-modified hemoglobin will reflect the level of carcinogen exposure during a period of nearly four months. It also possesses some metabolic competence, particularly, the ability to oxidize aromatic hydroxylamines to nitroso compounds which react quite efficiently with sulfhydryl groups. Albumin has a half-life of 20 to 25 days in man. This protein does not possess metabolic capacity other than, perhaps, some esterase activity. In contrast to hemoglobin, though, it is not protected by the erythrocyte membrane and might be the target for a greater number of carcinogens. It is present and is synthesized in the same cells in which the reactive metabolic intermediates of carcinogens are mostly formed - the hepatocytes. Also, albumin has a number of high-affinity binding sites for a broad spectrum of xenobiotics and endobiotics. 25 refs., 1 tab.

9954 **Development of an avidin-biotin amplified enzyme-linked immunoassay for detection of DNA adducts of the human bladder carcinogen 4-aminobiphenyl.** Roberts, D.W.; Benson, R.W.; Flammang, T.J.; Kudlubar, F.F. (National Center for Toxicological Research, Jefferson, AR). pp 479-488 of Mechanisms of DNA damage and repair: Implications for carcinogenesis and risk assessment. Simic, M.G.; Grossman, L.; Upton, A.C. (eds.). New York, NY; Plenum Press (1986). (CONF-850663—).

From International conference on DNA damage and repair - implications for carcinogenesis and risk assessment; Gaithersburg, MD, USA (3 Jun 1985).

4-Aminobiphenyl (ABP) is a known human urinary bladder carcinogen which is present in tobacco smoke and may be ubiquitous in the environment. As a biological monitor of carcinogen exposure, we have developed an immunological method for measuring the predominant carcinogen-DNA adduct of ABP, N-(deoxyguanosin-8-yl)-ABP (dG-C8-ABP). Rabbits were immunized with keyhold limpet hemocyanin (KLH) conjugate prepared by a periodate oxidation and coupling of N-(guanosin-8-yl)-ABP (rG-C8-ABP) to the protein. The resulting polyclonal antisera was systematically characterized using dual inhibitor methodology augmented by specialized computer and software support; and a competitive avidin-biotin enzyme-linked immunoassay (A-B ELISA) assay em-

ploying polyclonal rabbit anti-KLH-(rG-C8-ABP) was developed. Under the assay conditions described, the detection limit for dG-C8-ABP was 18 fmol/well. The relative lack of reactivity toward ABP, N-acetyl-4-aminobiphenyl, N-(deoxyadenosin-8-yl)-ABP, N-(deoxyguanosin-8-yl)-2-aminofluorene and deoxyguanosine as inhibitors indicated that primary specificity involves epitopes found on the purine and biphenyl rings. Results emphasize the need to define polyclonal anti-adduct sera operationally in the context of the antigen/assay system used to evaluate it. Assay sensitivity was achieved by decreasing the amount of antibody and solid-phase antigen in the competitive portion of the assay and the use of avidin-biotin as well as enzymatic amplification. This methodology is a useful alternative to other ultrasensitive techniques and should be directly applicable to the detection of ABP-DNA adducts in exposed human populations. 23 refs., 3 figs., 1 tab.

9955 **The role of pharmacokinetics in risk assessment.** Reitz, R.H.; Fox, T.R.; Watanabe, P.G. (Dow Chemical Co., Midland, MI). pp 499-507 of Mechanisms of DNA damage and repair: Implications for carcinogenesis and risk assessment. Simic, M.G.; Grossman, L.; Upton, A.C. (eds.). New York, NY; Plenum Press (1986). (CONF-850663—).

From International conference on DNA damage and repair - implications for carcinogenesis and risk assessment; Gaithersburg, MD, USA (3 Jun 1985).

Pharmacokinetics can aid in the formulation of risk estimations by selection of doses for toxicity studies, by distinguishing between "internal dose or toxifor concentration" and "applied dose," by providing a physiological basis for extrapolating between species, and by helping us to visualize the toxicological consequences of processes which we cannot quantify. 10 refs., 6 figs., 2 tabs.

9956 **Immunologic quantification of carcinogen-DNA adducts.** Santella, R.M.; Hsieh, Ling Ling; Perera, F. (Columbia Univ., New York, NY). pp 509-517 of Mechanisms of DNA damage and repair: Implications for carcinogenesis and risk assessment. Simic, M.G.; Grossman, L.; Upton, A.C. (eds.). New York, NY; Plenum Press (1986). (CONF-850663—).

From International conference on DNA damage and repair - implications for carcinogenesis and risk assessment; Gaithersburg, MD, USA (3 Jun 1985).

We have developed monoclonal antibodies to several carcinogen-DNA adducts, including DNA modified by benzo[a]pyrene diol epoxide (BPDE-I), 1-aminopyrene (1-AP) and 8-methoxypsoralen (8-MOP). Several stable clones have been isolated for each of the modified DNAs and characterized by enzyme-linked immunosorbent assay. All antibodies are highly specific for the appropriate modified DNA and do not cross-react with nonmodified DNA. The antibodies to BPDE-I-DNA have significant cross-reactivity with DNAs modified by similar antitrans diol epoxides of benz[a]anthracene and chrysene. These DNAs all contain N-2 of guanine adducts. The antibody probably recognizes a shared determinant encompassing the guanine base and the hydrocarbon ring containing the hydroxide groups. The antibodies cross-react with BPDE-I-dG, the monoadduct isolated from DNA, but with lower sensitivity than for the intact modified DNA. They do not react with acetylaminofluorene or 1-AP modified DNA, both of which contain C-8 of guanosine adducts. The antibodies to 1-AP-modified DNA demonstrate cross-reactivity with 8-nitro-1-aminopyrene- and 6-nitro-1-aminopyrene-modified DNA, as well as some slight cross-reactivity with BPDE-I-DNA and AAF-DNA. In general, all the antibodies have their highest reactivity with the original antigen and do not cross-react with the free carcinogens. Competitive ELISA with these antibodies can quantify modification levels with a sensitivity of about one adduct per 10^7 to 10^8 nucleotides. The antibodies are currently being used to measure adduct levels in animals exposed to carcinogens. 41 refs., 1 fig., 4 tabs.

9957 **Interpretation of genotoxicity data in assessing the risks of genetic diseases.** Denniston, C. (Univ. of Wisconsin, Madison). pp 519-527 of Mechanisms of DNA damage and repair: Implications for carcinogenesis and risk assessment. Simic, M.G.; Grossman, L.; Upton, A.C. (eds.). New York, NY; Plenum Press (1986). (CONF-850663—).

From International conference on DNA damage and repair - implications for carcinogenesis and risk assessment; Gaithersburg, MD, USA (3 Jun 1985).

Risk assessment may be either qualitative or quantitative. The screening of chemicals for mutagenicity is a qualitative matter, akin to a test of hypothesis in statistical analysis. Monitoring a population for an increase in the mutation rate also falls into this category. On the other hand, determining dose-response curves and estimating the impact on the population of an increase in exposure to some mutagenic agent is a quantitative process, involving statistical estimation. One example of each of these two kinds of assessment will be discussed, focusing on the logic of screening programs as an example of qualitative analysis, and the estimation of the impact of an increase of exposure to a mutagen on the frequencies of genetic disease. 11 refs., 3 figs., 5 tabs.

9958 **Use of models in low-dose extrapolation.** Van Ryzin, J. (Columbia Univ., New York, NY). pp 537-542 of Mechanisms of DNA damage and repair: Implications for carcinogenesis and risk assessment. Simic, M.G.; Grossman, L.; Upton, A.C. (eds.). New York, NY; Plenum Press (1986). (CONF-850663—).

From International conference on DNA damage and repair - implications for carcinogenesis and risk assessment; Gaithersburg, MD, USA (3 Jun 1985).

Based on three arguments favoring low-dose linearity, it appears that regulatory agencies in using mathematical models should use some form of linear low-dose extrapolation in assessing low-level environmental risk based on high-dose animal carcinogenicity data. That such estimates may overstate risk is quite plausible. However, to substantiate scientifically and rigorously that these low-dose risks do not exist appears beyond the scope of current animal bioassays. 13 refs., 1 fig., 2 tabs.

9959 **Problems in interspecies comparisons.** Wilson, R.; Crouch, E.A.C. (Harvard Univ., Cambridge, MA). pp 543-549 of Mechanisms of DNA damage and repair: Implications for carcinogenesis and risk assessment. Simic, M.G.; Grossman, L.; Upton, A.C. (eds.). New York, NY; Plenum Press (1986). (CONF-850663—).

From International conference on DNA damage and repair - implications for carcinogenesis and risk assessment; Gaithersburg, MD, USA (3 Jun 1985).

Attempts to find better ways of interspecies conversion all imply a model, from which some of the parameters can be determined by experiments which do not have the usual statistical error. 12 refs.

9960 **The time to tumor approach in risk assessment.** Albert, R.E. (New York Univ. Medical Center, NY). pp 551-556 of Mechanisms of DNA damage and repair: Implications for carcinogenesis and risk assessment. Simic, M.G.; Grossman, L.; Upton, A.C. (eds.). New York, NY; Plenum Press (1986). (CONF-850663—).

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The multistage model is currently a widely used mathematical tool in carcinogen risk assessment to obtain a low-dose linear non-threshold slope for estimating cancer risks and comparing carcinogens with respect to potency. However, the multistage model is a single pathway model, whereas biological evidence indicates that carcinogenesis proceeds through multiple pathways. Furthermore, recent studies suggest that carcinogens induce a generalized increase in the susceptibility to neoplastic transformation triggered as rare events by cell proliferation. Such evidence supports the dt/sup n/ = c time to tumor model in a modified form. 23 refs., 3 figs.

9961 **The role of nutritional factors in cellular protection against DNA damage, altered gene expression and malignant transformation.** Borek, C. (Columbia Univ., College of Physicians and Surgeons, New York, NY). pp 557-562 of Mechanisms of DNA damage and repair: Implications for carcinogenesis and risk assessment. Simic, M.G.; Grossman, L.; Upton, A.C. (eds.). New York, NY; Plenum Press (1986). (CONF-850663—).

From International conference on DNA damage and repair - implications for carcinogenesis and risk assessment; Gaithersburg, MD, USA (3 Jun 1985).

In recent years data from epidemiological studies and laboratory experiments have revealed numerous links between diet and cancer. The complex role of nutritional factors in modifying cancer incidence may be attributed in part to dietary agents acting as potentiators or promoters of cancer, serving as auxilliary agents to other environmental factors; as causes of cancer, or as cancer preventive agents. Studies can be carried on in vitro, in cell culture systems, where malignant transformation serves as an end point. These systems afford the opportunity to study the direct effect of nutrition in oncogenesis and the role of dietary factors in modulating the frequency and course of neoplastic development in its various stages. 20 refs., 1 fig., 3 tabs.

9962 **The role of risk assessment in food safety policy.** Scheuplein, R.J. (Food and Drug Administration, Washington, DC). pp 563-571 of Mechanisms of DNA damage and repair: Implications for carcinogenesis and risk assessment. Simic, M.G.; Grossman, L.; Upton, A.C. (eds.). New York, NY; Plenum Press (1986). (CONF-850663—).

From International conference on DNA damage and repair - implications for carcinogenesis and risk assessment; Gaithersburg, MD, USA (3 Jun 1985).

Virtually every category of food substance contains trace levels of carcinogens. Whether they are traditional foods like grains, cheese, or mushrooms, spices like pepper or nutmeg, migrants from packaging materials, residues from pesticides or animal drugs, or unavoidable impurities from additives in processed foods; it is impossible to purge them completely. As our awareness of the ubiquity of carcinogens has grown, there has been a growing need to distinguish between tolerable and intolerable risk from carcinogens in food. This distinction, which relies inter alia on the toxicological principle of dose-response, the essence of quantitative risk assessment, is now regarded as crucial in the regulation of carcinogens, as it has been in the regulation of non-carcinogens. Early FDA policy statements and the food safety laws themselves contained the implied promise of absolute safety from carcinogens in food. To understand the current role of carcinogen risk assessment in food safety policy, its relatively slow development, its conservative application, and the legal difficulties that still bar its wider use, a review of some of the history of the food laws in the US is provided. 24 refs.

9963 **Assessment of DNA damage by filter elution assays.** Kohn, K.W. (National Cancer Institute, National Institutes of Health, Bethesda, MD). pp 101-118 of Mechanisms of DNA damage and repair: Implications for carcinogenesis and risk assessment. Simic, M.G.; Grossman, L.; Upton, A.C. (eds.). New York, NY; Plenum Press (1986). (CONF-850663—).

From International conference on DNA damage and repair - implications for carcinogenesis and risk assessment; Gaithersburg, MD, USA (3 Jun 1985).

DNA lesions fall into several classes based on the techniques available for sensitive measurement. In mammalian cells, sensitive measurements of the greatest variety of distinguishable DNA lesion classes has been achieved by means of the techniques of alkaline or neutral elution of DNA from filters. The main distinguishable classes of lesions include single-strand breaks, double-strand breaks, alkali-labile sites, interstrand crosslinks, DNA-protein crosslinks and protein-associated strand breaks. Each of these lesion classes includes a variety of chemical types of breaks or crosslinks at different DNA sites which may differ in their biological consequences; hence generalizations about the biological significance of a given lesion class may not work for all cases. This paper reviews some recent findings which relate to the biological significance of DNA damage measured by filter elution methods. 56 refs., 2 tabs.

9964 **DNA modification by sulfur mustards and nitrosoureas and repair of these lesions.** Ludlum, D.B.; Papirmeister, B. (Albany Medical College, NY; Army Medical Research Institute of Chemical Defense, Aberdeen Proving Ground, MD). pp 119-125 of Mechanisms of DNA damage and repair: Implications for carcinogenesis and risk assessment. Simic, M.G.; Grossman, L.; Upton, A.C. (eds.). New York, NY; Plenum Press (1986). (CONF-850663—).

From International conference on DNA damage and repair - implications for carcinogenesis and risk assessment; Gaithersburg, MD, USA (3 Jun 1985).

The nature and significance of DNA modifications caused by chloroethyl ethyl sulfide (CEES) is compared with those produced by chloroethyl cyclohexyl nitrosourea (CCNU). This comparison illustrates the differences in the kind of biological response which can arise from DNA modification by different agents and the role of DNA repair in determining this response. In particular, the ability of tumor cells to become resistant to therapeutic agents has some important implications for the ability of cells in general to tolerate environmental mutagens. DNA modification by CEES and CCNU can be viewed in the context of DNA modification caused by compounds which naturally react with DNA. For example, cycasin and S-adenosylmethionine both methylate DNA. Not surprisingly, a variety of repair mechanisms has evolved which serve to maintain the integrity of DNA in the presence of such naturally-occurring DNA modifiers. The ability of these enzymes to repair other DNA lesions is currently under active investigation as described here. 19 refs., 4 figs., 3 tabs.

5604 Other Environmental Pollutant Effects

9965 **(AD-A—184561/9/XAB) Compilation of 1986 annual reports of the Navy ELF (extremely low frequency) communications system ecological-monitoring program. Volume 1. Tabs A-C. Annual progress report, January-December 1986.** (IIT Research Inst., Chicago, IL (USA)). Jul 1987. 449p. (IITRI-E—06549-38-VOL-1). NTIS, PC A19/MF A01.

See also Volume 2, AD-A184 562.

This is the fifth compilation of annual reports for the Navy's ELF Communications System Ecological Monitoring Program. This report documents the progress of the following studies: Herbaceous Plant Cover and Tree Studies; Litter Decomposition and Microflora; and The Effects of Exposing the Slime Mold Physarum Polycephalum to Electromagnetic Fields.

9966 **(AD-A—184562/7/XAB) Compilation of 1986 annual reports of the Navy ELF (extremely low frequency) communications system ecological-monitoring program. Volume 2. Tabs D-G. Annual progress report, January-December 1986.** (IIT Research Inst., Chicago, IL (USA)). Jul 1987. 344p. (IITRI-E—06549-38-VOL-2). NTIS, PC A15/MF A01.

See also Volume 3, AD-A184 563.

The U.S. Navy is conducting a long-term program to monitor for possible effects from the operation of its Extremely Low Frequency (ELF) Communications System to resident biota and their ecological relationships. This report documents progress of the following studies: Soil Amoeba; Soil and Litter Arthropoda and Earthworm Studies; Biological Studies on Pollinating insects: Megachilid Bees; and Small Vertebrates: Small Mammals and Nesting Birds.

9967 **(AD-A—184563/5/XAB) Compilation of 1986 annual reports of the Navy ELF (extremely low frequency) communications system ecological-monitoring program. Volume 3. Tabs H-J. Annual progress report, January-December 1986.** (IIT Research Inst., Chicago, IL (USA)). Jul 1987. 418p. (IITRI-E—06549-38-VOL-3). NTIS, PC A18/MF A01.

See also Volume 1, AD-A184 561.

This is the fifth compilation of annual reports for the Navy's ELF Communications System Ecological Monitoring Program. This report documents the progress of the following studies: Aquatic Ecosystems; Wetland Studies; Bird Species and Communities.

9968 **(DOE/ER/60099—T3) Biological effects of power line fields: New York State Power Lines Project Scientific Advisory Panel: Final report.** Ahlbom, A.; Albert, E.N.; Fraser-Smith, A.C.; Grodzinsky, A.J.; Marron, M.T.; Martin, A.O.; Persinger, M.A.; Shelanski, M.L.; Wolpow, E.R. (New York State Dept. of Health, Albany (USA)). 1 Jul 1987. Contract FG02-82ER60099. 169p. NTIS, PC A08/MF A01; 1; GPO Dep. Order Number DE88002346/JAW.

The New York State Power Lines Project was established to conduct research and to review the scientific literature to determine whether health hazards of electric and magnetic fields are possible. Particular attention was directed to the fields generated by 765-kV overhead transmission lines. The research program provided support to 16 research groups studying human, animal and isolated cell sensitivity to electric and magnetic fields. No effects were found on reproduction, growth or development. Several studies showed no evidence of genetic or chromosomal damage that might lead to inherited effects or cause cancer. While most measurements of behavior and brain function did not demonstrate changes, some did show changes that were small but consistent. Some of these appear to result from changes in body rhythms, and might interfere with normal sleep patterns. There were also changes in pain responses and in the ability of rats to learn. A more serious concern comes from a study of cancer in children suggesting that children with leukemia and brain cancer are more likely to live in homes where there are elevated 60-Hz magnetic field levels. Although much more research is needed before the question whether the magnetic fields actually cause or promote cancer can be resolved, the basis for such an hypothesis is now established. 159 refs., 12 figs., 7 tabs.

9969 **(INIS-mf—10747) Oxygen consumption and mortality rate of mice after X radiation under the influence of magnetic fields.** Rekbi, M. (Tieraerztliche Hochschule Hannover (Germany, F.R.). Fachgebiet Medizinische Physik). 13 Dec 1984. 54p. (In German). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88751021/JAW.

In this work it was studied whether an influence on the oxygen use was to be expected as a result of a magnetic pulsating field. This could not be determined. An increased effect of the magnetic field with respect to the reduction of the mortality rate was, however, to be observed. Thereby the influence of similar constant and pulsating fields was discussed from various perspectives. The question of the biological effect mechanism of the magnetic field (main issue of the influence of the magnetic field during or after the irradiation) can only be answered by further comprehensive investigations.

57 HEALTH AND SAFETY

REFER ALSO TO CITATION(S) 8556, 9915, 9918

9970 **(CONF-871188—1) Analysis of individual risk belief structures.** Tonn, B.E.; Travis, C.B.; Arrowood, L.; Goeltz, R.; Mann, C.A. (Oak Ridge National Lab., TN (USA); Tennessee Univ., Knoxville (USA)). 1987. Contract AC05-84OR21400. 17p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88002610/JAW.

From Annual meeting of the Society for Risk Analysis; Houston, TX, USA (1 Nov 1987).

An interactive computer program developed at Oak Ridge National Laboratory is presented as a methodology to model individualized belief structures. The logic and general strategy of the model is presented for two risk topics: AIDs and toxic waste. Subjects identified desirable and undesirable consequences for each topic and formulated an associative rule linking topic and consequence in either a causal or correlational framework. Likelihood estimates, generated by subjects in several formats (probability, odds statements, etc.), constituted one outcome measure. Additionally, source of belief (personal experience, news media, etc.) and perceived personal and societal impact are reviewed. Briefly, subjects believe that AIDs causes significant emotional problems, and to a lesser degree, physical health problems whereas toxic waste causes significant environmental problems.

9971 **(ORNL/TM—10600) Quality assurance/quality control in waste site characterization and remedial action: Final report, December 1986-June 1987.** Maskarinec, M.P.; Holladay, S.K. (Oak Ridge National Lab., TN (USA)). Oct 1987. Contract AC05-84OR21400. 73p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE88003695/JAW.

This report details efforts to date to advance the state of the art of Quality Assurance/Quality Control (QA/QC) in waste site characterization and remedial action. The report is organized into three sections. The first section provides recommendations on the unification of the two widely used and accepted QA/QC programs: the US Environmental Protection Agency Contract Laboratory program (USEPACLP) and the US Army Toxic and Hazardous Materials Agency Installation Restoration Quality Assurance (USATHAMA IR QA) plan. The second section compares the two plans in detail with the Guidelines given by the USEPA. The third section announces the formation of a Task force on Quality Assurance/Quality Control and reports on the findings of a Working Group convened to address these issues.

58 GEOSCIENCES

5801 Geology And Hydrology

REFER ALSO TO CITATION(S) 8574, 8598, 8599, 8600

9972 **(LBL—22116) Three dimensional modeling of fractures in rock: From data to a regionalized parent-daughter model.** Hestir, K.; Chiles, J.P.; Long, J.; Billaux, D. (Lawrence Berkeley Lab., CA (USA); Bureau de Recherches Geologiques et Minieres (BRGM), 45 - Orleans (France)). Apr 1987. Contract AC03-76SF00098. 18p. (CONF-861220—8). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88002738/JAW.

From American Geophysical Union fall meeting; San Francisco, CA, USA (8 Dec 1986).

We introduce a stochastic model for fracture systems called the parent-daughter model. The model uses circular discs to represent fractures. The discs are placed in three-dimensional space according to a random process called the parent-daughter point process. This process will give a clustering of fractures that cannot be produced with the usual Poisson process. We then outline a procedure for fitting the model to a particular data set.

9973 **(ORNL/Sub—86-32136/3/V1) Installation of packers and hydraulic testing of core holes CH-1 through CH-5 ORNL Plant Area: Volume 1 of 2.** Lozier, W.B.; Pearson, R. (Golder Associates, Inc., Atlanta, GA (USA)). Nov 1987. Contract AC05-84OR21400. 132p. NTIS, PC A07/MF A01; 1; GPO Dep. Order Number DE88003740/JAW.

Geohydraulic packer testing was completed in coreholes CH-1 through CH-5 in Bethel Valley at the Oak Ridge National Laboratory X-10 Plant Area. The coreholes penetrate rocks of the Chickamauga Group and range in depth from 350 feet to about 400 feet. A straddle packer assembly consisting of two sliding-end pneumatic packers, a downhole pneumatically activated shut-in valve and three downhole vibrating wire pressure transducers was utilized to complete the testing. The transducers were used to monitor the rock formation hydraulic pressure above the top packer, in the tested interval, and below the bottom packer. A total of 38 packer tests were completed. Hydraulic conductivity results from corehole 1 ranged from about 5×10^{-9} cm/s to 1×10^{-4} cm/s. Corehole 2 results ranged from about 1×10^{-8} cm/s to 8×10^{-6} cm/s. Corehole 3 results ranged from about 2×10^{-8} cm/s to about 1×10^{-6} cm/s. Corehole 4 results ranged from about 4×10^{-8} cm/s to 5×10^{-9} cm/s, and those in corehole 5 ranged from about 4×10^{-7} cm/s to 6×10^{-9} cm/s. The static head distribution across coreholes CH-1 through CH-5 indicate significant artesian pressures at depth with a general upward gradient.

9974 (ORNL/Sub—86-32136/3/V2) Installation of packers and hydraulic testing of Core Holes CH-1 through CH-5, ORNL Plant area: Volume 2 of 2. Lozier, W.B.; Pearson, R. (Golder Associates, Inc., Atlanta, GA (USA)). Nov 1987. Contract AC05-84OR21400. 288p. NTIS, PC A13. Order Number DE88003686/JAW.

Geohydraulic packer testing was completed in coreholes CH-1 through CH-5 in Bethel Valley at the Oak Ridge National Laboratory X-10 Plant Area. The coreholes penetrate rocks of the Chickamauga Group and range in depth from 350 feet to about 400 feet. A straddle packer assembly consisting of two sliding-end pneumatic packers, a downhole pneumatically activated shut-in valve and three downhole vibrating wire pressure transducers was utilized to complete the testing. This volume contains the following appendices: (1) field data; (2) horner analyses; (3) rising head analyses; and (4) pressure slug analyses.

9975 (SAND—87-1918) Proceedings of the wellbore sampling workshop. Traeger, R.K. (ed.); Harding, B.W. (Sandia National Labs., Albuquerque, NM (USA)). Nov 1987. Contract AC04-76DP00789. 129p. (CONF-8705210—Summs.). NTIS, PC A07/MF A01; 1; GPO Dep. Order Number DE88002821/JAW.

From Wellbore sampling workshop; Houston, TX, USA (27 May 1987).

Representatives from academia, industry and research laboratories participated in an intensive two-day review to identify major technological limitations in obtaining solid and fluid samples from wellbores. Top priorities identified for further development include: coring of hard and unconsolidated materials; flow through fluid samplers with borehole measurements T, P and pH; and non-intrusive interrogation of pressure cores.

9976 Process for structural geologic analysis of topography and point data. Eliason, J.R.; Eliason, V.L.C. (to Dept. of Energy, Washington, DC). US Patent 4,698,759. 6 Oct 1987. Filed date 28 Mar 1985. vp. Patent and Trademark Office, Box 9, Washington, DC 20232.

The method of analyzing topographical data to detect and plot geological fracture and/or bedding planes is described, comprising: inputting a matrix of data derived from undulations of the earth into a computer memory wherein the matrix comprises point elevations over a geographical area corresponding to the matrix, comparing the point elevations within a predetermined detection area smaller than the geographical area to determine lower points identified as valley points, assembling adjacent valley points into strings, and the strings into vectors of substantially common direction, comparing vectors to determine vectors lying in substantially common planes, and outputting data identifying the substantially common planes.

5802 Geophysics

REFER ALSO TO CITATION(S) 8630

9977 (UCRL—97583) Results from shallow research drilling at Inyo Domes, Long Valley Caldera, California and Salton Sea geothermal field, Salton Trough, California. Younker, L.W.; Eichelberger, J.C.; Kasameyer, P.W.; Newmark, R.L.; Vogel, T.A. (Lawrence Livermore National Lab., CA (USA); Sandia National Labs., Albuquerque, NM (USA); Michigan State Univ., East Lansing (USA)). Sep 1987. Contract W-7405-ENG-48. 19p. (CONF-8709190—1). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88002665/JAW.

From 3. international symposium on observation of the continental crust through drilling; Mora, Sweden (7 Sep 1987).

This report reviews the results from two shallow drilling programs recently completed as part of the United States Department of Energy Continental Scientific Drilling Program. The purpose is to provide a broad overview of the objectives and results of the projects, and to analyze these results in the context of the promise and potential of research drilling in crustal thermal regimes. The Inyo Domes drilling project has involved drilling 4 shallow research holes into the 600-year-old Inyo Domes chain, the youngest rhyolitic event in the coterminous United States and the youngest volcanic event in Long Valley Caldera, California. The purpose of the drilling at Inyo was to understand the thermal, chemical and mechanical behavior of silicic magma as it intrudes the upper crust. This behavior, which involves the response of magma to decompression and cooling, is closely related to both eruptive phenomena and the establishment of hydrothermal circulation. The Salton Sea shallow research drilling project involved drilling 19 shallow research holes into the Salton Sea geothermal field, California. The purpose of this drilling was to bound the thermal anomaly, constrain hydrothermal flow pathways, and assess the thermal budget of the field. Constraints on the thermal budget links the local hydrothermal system to the general processes of crustal rifting in the Salton Trough.

9978 Tectonic development of Columbia Plateau. Reidel, S.B.; Chamness, M.A.; Fecht, K.R.; Hagood, M.C.; Nolan, T.L. (Rockwell International, Richland, WA). *AAPG Bulletin;* 71: No. 8, 1013(Aug 1987). (CONF-870915—).

From American Association of Petroleum Geologists Rocky Mountain Section meeting; Boise, ID, USA (13 Sep 1987).

The Columbia Plateau can be subdivided into two structural subprovinces: the Palouse, characterized by the Blue Mountain anticlinorium, and the Yakima foldbelt, characterized by generally narrow, asymmetric (faulted) anticlinal ridges separated by broad basins. The tectonic features of the Columbia Plateau result from (1) north-south compression during and following the emplacement of the Columbia River Basalt (CRB); (2) the subsidence of the Yakima foldbelt subprovince relative to a stable Palouse subprovince; (3) the growth of the Yakima folds superimposed on a subsiding basin; (4) the growth of major northwest-trending strike-slip faults on the western side of the plateau; and (5) the influence of regional structures that trend into the Columbia Plateau. Subsidence of the Yakima foldbelt subprovince began prior to the eruption of the CRB and has continued from the Miocene to the present. The rate of subsidence kept pace with CRB emplacement, decreasing as eruption rates waned. Simultaneously, anticlinal fold growth within the Yakima foldbelt occurred under north-south compression, and decreased as the rate of subsidence and CRB eruptions declined. Paleomagnetic data indicate fold growth was accompanied by a component of clockwise rotation that occurred on a local scale and only in anticlines. The development of these tectonic features is consistent with oblique subduction along a converging plate margin.

9979 Fiber-optic seismometer. Rodgers, P.W.; Davis, C.M.; Eustace, J.G.; Zarobila, C.J. (Optical Technologies, Inc., Herndon, VA). pp 203-211 of Fiber optic and laser sensors IV. De Paula, R.P.; Udd, E. Bellingham, WA; SPIE (1986). (CONF-8609127—).

From SPIE symposium on optics and optoelectronics; Cambridge, MA, USA (14 Sep 1986).

This paper reviews the present state of seismometry and discusses a seismometer based on fiber-optic technology. In addition, some actual data taken by a portable laboratory-grade fiber-optic seismometer is presented.

5803 Mineralogy, Petrology, And Rock Mechanics

REFER ALSO TO CITATION(S) 9176

5804 Geochemistry

9980 (CONF-8709190—2) Trace elements in Gravberg drillhole samples. Jovanovic, S.; Reed, G.W. Jr. (Argonne National Lab., IL (USA)). 1987. Contract W-31109-ENG-38. 9p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88002937/JAW.

From 3. international symposium on observation of the continental crust through drilling; Mora, Sweden (7 Sep 1987).

Trace elements in Gravberg drillhole samples in granitic rock at the Siljan impact structure in Sweden were studied. The impact structure is the first non-sedimentary basin related formation to be used to test the thesis of abiogenic hydrocarbon resources.

Trace element data were correlated with hydrocarbon profiles and other indicators of sources and transport of hydrocarbon related volatiles such as H_2 and He and with rock porosities. Volatile trace elements, especially Hg, are being studied. An understanding of the distribution and migration of Hg can provide insights into the behavior of volatiles such as CH_4. Hg is measured in stepwise heating experiments. Labile (≦130°C) and retentive (up to 1200°C) sites are identified. The former are related to gases, the latter to less volatile elements and/or compounds. Data on other volatiles such as Se, Sb, Zn, and relatively non-volatile Fe, Co, Sc, and REE are also utilized.

64 PHYSICS I

9081 (INIS-mf—11054) 1987 Annual convention of the Austrian Physical Society. (Oesterreichische Physikalische Gesellschaft, Vienna). Sep 1987. 97p. (In German and English). (CONF-8709196—). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88700772/JAW.

From Annual convention fo the Austrian Physical Society; Vienna, Austria (21 Sep 1987).

This is the pre-convention program of the annual convention to be held in September 1987. The divisions 1) general, 2) nuclear - and particle physics, 3) high-polymer physics have 124 contributions with abstracts, 75 of them of INIS interest. Another 22 contributions from the divisions, 4) atomic -, nuclear - and plasma physics, 5) solid state physics and 6) vocational training, are announced ty titles only. (G.Q.).

6401 Astrophysics And Cosmology

REFER ALSO TO CITATION(S) 9141, 9141

9082 (ANL-HEP-CP—86-139) A combined cosmic ray muon spectrometer and high energy air shower array. Cherry, M.L.; Ayres, D.S.; Halzen, F. (Pennsylvania Univ., Philadelphia (USA). Dept. of Physics; Argonne National Lab., IL (USA); Wisconsin Univ., Madison (USA). Dept. of Physics). 1986. Contract W-31109-ENG-38. 5p. (CONF-8606215—46). NTIS, PC A02. Order Number DE88003057/JAW.

From Summer study on the physics of the superconducting super collider; Snowmass, CO, USA (23 Jun 1986).

Cosmic rays have been detected at energies in excess of 10^{20} eV, and individual sources have been conclusively identified as intense emitters of gamma rays at energies up to 10^{16} eV. There is clearly a great deal of exciting astrophysics to be learned from such studies, but it has been suggested that there may be particle physics to be learned from the cosmic beam as well. Based in particular on the reports of surprisingly high fluxes of underground muons from the direction of Cygnus X-3 modulated by the known orbital period, there have been several suggestions recently invoking stable supersymmetric particles produced at Cygnus X-3, enhanced muon production from high energy photons, quark matter, and "cygnets." Although the underground muon results have been questioned, it may still be worthwhile to consider the possibility of new physics beyond the standard model with energy scale (G/sub F/)/sup -1/2/ ≧ 0.25 TeV. For example, there have been recent discussions on the experimental signatures to be observed from new high energy photon couplings to matter, exchanges between constituent quarks and leptons, and stable gluinos and photinos mixed in with the cosmic gamma ray flux. We describe here a possible detector to search for such effects. We utilize the possibility that point sources like Cygnus X-3 can be used to provide a directional time-modulated "tagged" high energy photon beam.

9083 (ANL-HEP-CP—87-98) Angular resolution in underground detectors and a status report of the Soudan II nucleon decay detector. Ambats, I.; Ayres, D.; Barrett, W.; Barron, K.; Dawson, J.; Fields, T.; Goodman, M.C.; Lopez, F.; May, E.; Price, L. (Argonne National Lab., IL (USA); Minnesota Univ., Minneapolis (USA); Oxford Univ. (UK); Rutherford Appleton Lab., Chilton (UK); Tufts Univ., Medford, MA (USA)). 1987. Contract W-31109-ENG-38. 9p. (CONF-8708147—2). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88002931/JAW.

From International symposium on underground physics; Baksan, USSR (17 Aug 1987).

This paper is a status report of the Soudan II honeycomb drift chamber project. It reports on the physics goals, present progress and future schedule of our experiment. It also includes a discussion of the angular resolution of cosmic ray muons which can be achieved in underground detectors, and in particular how to calibrate the resolution using the moon's shadow in cosmic rays. This last point has relevance in trying to understand the angular distributions in the reported observations of underground muons from Cygnus X-3. 12 refs., 9 figs.

9084 (CBPF-NF—002/87) Modified theory of gravity. Novello, M.; Pinto Neto, N. (Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro; Rio de Janeiro Univ., Brazil. Inst. de Fisica). (Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro). 1987. 13p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88700835/JAW.

A theory of gravity wich considers the topological invariant $I = R^*$/sub α//sup $\beta\mu\nu$/ R/sup $\alpha\beta\mu\nu$/ as one of the basic quantities to be present in the description of the dynamics of gravitational interactions is presented. A cosmical scenario induced by this theory is sketched.

9085 (CENBG—8702) Study of production by cosmic radiation of krypton and xenon in the Saint-Severin meteorite. Lavielle, B. (Bordeaux-1 Univ., 33 - Gradignan (France). Centre d'Etudes Nucleaires). Jan 1987. 154p. (In French). NTIS (US Sales Only), PC A08/MF A01. Order Number DE88751576/JAW.

The concentrations of Kr and Xe isotropes have been measured by a high sensitivity mass spectrometry technique in 11 samples from a core of the Saint-Severin meteorite. On the basis of our results, we were able to show the role of the shielding depth on the production of Kr and Xe by cosmic ray bombardment. More-over, the experimental results for krypton were compared with calculated values obtained by the Reedy and Arnold model (1972) adapted to cosmic ray irradiation of small spherical objects. Our elaboration of a new systematics of nuclear reactions has lead to a good agreement between experiments and calculations within this model.

9086 (CONF-8612112—1) Crystal diffraction lenses for imaging gamma-ray telescope. Smither, R.K. (Argonne National Lab., IL (USA)). Jun 1987. Contract W-31109-ENG-38. 6p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88003084/JAW.

From 13. Texas symposium on relativistic astrophysics; Chicago, IL, USA (25 Dec 1986).

Recent developments in the design of crystal diffraction lenses has made it possible to build a gamma-ray telescope that produces a real image of a distant object. This can be done both with surface diffraction optics and with transmission diffraction optics. The mathematical solution to both cases is the same but they differ in the way the crystals are cut and bent. Until recently, there was no solution for the transmission case. It is this last case that will be highlighted in this paper, because it is new and because it makes much more efficient use of the crystal material when high energy photons (>50 keV) are being focused. 5 refs., 8 figs.

9087 (DOE/ER/40211—3) Research in theoretical physics: Annual progress report for period April 1, 1987-March 31, 1988. Domokos, G.; Kovesi-Domokos, S. (Johns Hopkins Univ., Baltimore, MD (USA). Dept. of Physics and Astronomy). Nov 1987. Contract FG02-85ER40211. 15p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88003201/JAW.

We report results in the following areas: phenomenological study of cosmic ray events with an anomalously large number of muons. We suggest that the "anomalous" events can be understood in terms of a substructure of quarks and leptons. We propose experiments to test this hypothesis and also to determine whether the primaries are photons or neutrinos, study of spontaneous compactification - technical progress has been made towards developing a stability analysis of partially compactified vacuum solutions in theories of gravity in higher dimensions, a preliminary study of algebras

potentially describing quark and lepton substructure. The algebras are infinite dimensional, non-commutative Jordan algebras, they generalize ordinary Fermi and Bose algebras, and implementation of techniques of quantum field theory in the theory of turbulence. The statistical theory of fully developed turbulence is structurally similar to a Euclidean quantum field theory. By using modern techniques developed within the context of quantum field theory, a more efficient description of turbulence appears possible. 22 refs.

9988 **(IFT-P—12/87) Search for QSOs to fit a cosmological model with flat, closed spatial sections.** Fagundes, H.V.; Wichoski, U.F. (Instituto de Fisica Teorica, Sao Paulo (Brazil)). 1987. 9p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88700862/JAW.

From the hypothesis that our Galaxy, in an early stage of its evolution, was a quasar, it is assumed that images of this stage can still be observed in the sky. Thus, a quasar catalog is investigated for the ones that can possibly interpreted as images of our Galaxy in that stage, expecting to fit an Einstein-de Sitter cosmological model with 3-torus topology for the spatial sections.

9989 **(INFN/AE—86-9) Possible cosmological consequences of thermodynamics in a unified approach to gravitational and strong interactions.** Recami, E.; Tonin Zanchin, V.; Martinez, J.M. (Istituto Nazionale di Fisica Nucleare, Catania (Italy)). 1986. 10p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88700766/JAW.

A unified geometrical approach to strong and gravitational interactions has been recently proposed, based on the classical methods of General Relativity. According to it, hadrons can be regarded as black-hole type solutions of new field equations describing two tensorial metric-field (the ordinary gravitational field, and the strong one). In this paper, we first seize the opportunity for an improved exposition of some elements of the theory relevant to our present scope. Secondly, by extending the Bekenstein-Hawking thermodynamics to the above mentioned strong black-holes (SBH), it is shown: 1) that SBH thermodynamics seems to require a new expansion of our cosmos after its Big Crunch (i.e. that a recontraction of our cosmos has to be followed by a new creation); 2) that a collapsing star with mass M approximately in the range 3 to 5 solar masses, once reached the neutron-star density, could re-explode tending to form a (radiating) object with a diameter of the order of 1 light-day: thus failing to create a gravitational black-hole. 28 refs.

9990 **(INIS-BR—875) Structure of neutron stars.** Cheong, C.K. (Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro). 22 Nov 1974. 106p. (In Portuguese). NTIS (US Sales Only), PC A06/MF A01. Order Number DE88700409/JAW.

Structure of neutron stars consisting of a cold and catalyzed superdense matter were investigated by integrating the equations for hydrostatic equilibrium based on the General Relativity theory. The equations of state were obtained with the help of semiempirical nuclear mass formulae. A large phase transition was found between the nuclear and subnuclear density regions. The density phase transition points were calculated as 6.2 x 10/sup 11/ and 3.8 x 10/sup 13/ g/cm/sup 3/. Due to such a large phase transition, the equation of state practically consists of two parts: The nuclear and subnuclear phases wich are in contact under the thermodynamical equilibrium at the corresponding pressure. Some macroscopic properties of neutron stars are discussed.

9991 **(ITEF—92-1986) Onset of type 2 supernova in circumstellar envelope created by the stellar wind from presupernova.** Grasberg, Eh.K.; Nadezhin, D.K. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1986. 24p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88700448/JAW.

The influence of extended circumstellar envelopes on photometric properties and dynamics of type 2 supernovae is investigated. The typical stellar wind of late giants and supergiants (with C/sub rho/ $\leqq$ 10/sup 13/ g/cm is shown to have virtually no influence on the supernova light curves. If the mass loss from presupernova is, however, more intensive, the following effects take place: 1) the supernova luminosity increases 1-2 magnitudes but the duration of the light curve plateau remains unchanged; 2) the shape of the light curve is plateau like o the whole but if the radius of circumstellar envelope is less than ~ 2x10/sup 4/ R/sub sun/, a step (Δ m ~ 1-2 magnitude) on light curve is expected; 3) in the plateau phase of the light curve, the colour index (B-V) may increase steadily in time. For circumstellar envelopes of very high density (C/sub rho/ >or approx. 10/sup 17/ g/cm), the nearmaximum dome may appear on the light curve. The interaction of supernova envelope with stellar wind leads to formation of a thin (spatially but not optically) and dense spherical layer in which true absorption dominates Thompson scattering. 17 refs.; 11 figs.; 1 tab.

9992 **(LA-UR—87-3688) Transverse flow deflections associated with fast coronal mass ejecta in interplanetary space.** Gosling, J.T.; Thomsen, M.F.; Bame, S.J.; Zwickl, R.D. (Los Alamos National Lab., NM (USA)). 1987. Contract W-7405-ENG-36. 6p. (CONF-8708141—5). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88003180/JAW.

From 6. meeting of solar wind; Estes Park, CO, USA (24 Aug 1987).

Using a bidirectional electron heat flux signature to identify coronal mass ejections, CMEs, in the solar wind at 1 AU, we find that the fast CMEs which drive interplanetary shocks are preferentially deflected eastward in transit outward from the sun. A corresponding westward deflection usually occurs in the compressed ambient solar wind plasma ahead of these CMEs. We suggest that this preferential pattern of deflections is caused primarily by the asymmetrical draping of the ambient interplanetary magnetic field about fast CMEs. 10 refs., 7 figs.

9993 **(LA-UR—87-3998) Personal overview of solar wind 6.** Gosling, J.T. (Los Alamos National Lab., NM (USA)). 1987. Contract W-7405-ENG-36. 8p. (CONF-8708141—6). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88003147/JAW.

From 6. meeting of solar wind; Estes Park, CO, USA (24 Aug 1987).

The author reviews papers presented at the Solar Wind 6 Proceedings. The particular topics discussed are solar wind acceleration theory, heliosphere production of solar winds, coronal mass ejections, interplanetary shock disturbance, and solar wind ionic composition. A concern for the steady decline in solar wind observations is expressed. (LSP)

9994 **(LBL—24067) An introduction to nuclear astrophysics.** Norman, E.B. (Lawrence Berkeley Lab., CA (USA)). Sep 1987. Contract AC03-76SF00098. 24p. (CONF-8707131—1). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88002761/JAW.

From Latin American School of Physics conference; La Plata, Argentina (6 Jul 1987).

The role of nuclear reactions in astrophysics is described. Stellar energy generation and heavy element nucleosynthesis is explained in terms of specific sequences of charged-particle and neutron induced reactions. The evolution and final states of stars are examined. 20 refs. 11 figs., 2 tabs.

9995 **(RAL—86-009) Flares on dMe stars: IUE and optical observations of At Mic, and comparison of far-ultraviolet stellar and solar flares.** Bromage, G.E.; Phillips, K.J.H.; Dufton, P.L.; Kingston, A.E. (Rutherford Appleton Lab., Chilton (UK)). Jan 1986. 63p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE88750696/JAW.

The paper concerns observations of a large flare event on the dMe star At Mic, detected by the International Ultraviolet Explorer. The far-ultraviolet spectra of the flare is compared with those of other stellar flares, and also with a large solar flare recorded by the Skylab mission in 1973. The quiescent-phase optical and ultraviolet spectrum of the same dMe flare star is discussed. (U.K.).

9996 **(RAL—86-017) Survey of interstellar sulphur abundance and implications for PII oscillator strengths.** Harris, A.W.; Mas Hesse, J.M. (Rutherford Appleton Lab., Chilton (UK)). Feb 1986. 20p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88750688/JAW.

To be published in the Astrophysical Journal.

A study of interstellar gas-phase sulphur abundance is presented which is based mainly on abundances for 39 sight-lines newly derived from recently published Copernicus UV absorption line measurements and de-archived IUE data. A trend of increasing depletion with increasing mean hydrogen volume density, n-bar(H), is evident. The correlation of sulphur depletion with reddening per kpc is relatively poor. The results confirm that sulphur is not a major constituent of interstellar grains. A comparison of Doppler widths derived for SII and PII in the same sight-lines reveals an unexpected systematic discrepancy of a factor of approx. 1.7. The possibility that this is due to inaccuracy of the normally adopted oscillator strengths for the PII lambda1153 and lambda1302 A lines is discussed.

9097 (RAL—86-047) Centaurus cluster of galaxies. 3. Its structure and the distribution of the different galaxy types. Lucey, J.R.; Currie, M.J.; Dickens, R.J. (Rutherford Appleton Lab., Chilton (UK)). May 1986. 41p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88750759/JAW.

Previous work by the authors has shown that the Centaurus cluster (α = 12sup(h) 47 delta = -41°) is composed of two velocity components, Cen30 (mean velocity 3000 km s^{-1}) and Cen45 (mean velocity 4500 km s^{-1}), which very probably lie within one cluster. In this paper the internal structure of the cluster is described and the spatial and velocity distributions of the different galaxy types within the cluster are discussed.

9098 (UCRL—97444) New nuclear structure calculations and the astrophysical r-process. Howard, W.M.; Moeller, P.; Mathews, G.J.; Meyer, B.S. (Lawrence Livermore National Lab., CA (USA)). Sep 1987. Contract W-7405-ENG-48. 18p. (CONF-8708165—3). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88000979/JAW.

From Symposium on the origin and distribution of elements; New Orleans, LA, USA (31 Aug 1987).

Recent developments in nuclear-structure calculations used to calculate the nuclear properties of neutron-rich heavy elements can have a dramatic effect on astrophysical r-process calculations. In particular, in the context of the macroscopic-microscopic method, studies of the effect of the finite range of the nuclear force on the surface energy, the shape dependence of the Wigner term, new shape degrees of freedom near scission, and improved single particle potentials for neutron-rich heavy elements have led to improved calculations of the properties of heavy elements. We will discuss preliminary applications of these new models to nuclei of interest in the astrophysical r-process and the implications for nuclear cosmochronology and the existence of superheavy elements in nature. 14 refs., 6 figs.

9099 Some nuclear data needs in astrophysics. Mathews, G.J.; Bauer, R.W.; Bloom, S.D.; Haight, R.C.; Howard, W.M.; Takahashi, K.; Ward, R.A. (California Univ., Livermore, USA. Lawrence Livermore National Lab.). *Radiation Effects;* **94**: No. 1-4, 161-178(1986). (CONF-850507—).

From International conference on nuclear data for basic and applied science; Santa Fe, NM, USA (13 May 1985).

In this paper a number of astrophysical environments are discussed and also how improved nuclear data could facilitate a better understanding of them. One area of interest includes proton and alpha-particle reactions with unstable nuclei which are necessary for under-standing the nucleosynthesis and energy generation in hot hydrogen-burning environments. Efforts underway at LLNL and elsewhere to develop the technology for the measurement of these reaction rates are discussed. Heavy-element nucleosynthesis in the late stages of red-giant stars and supernovae requires a complete network of neutron capture rates and beta-decay rates for nuclei near and far from stability. Experimental and theoretical efforts at LLNL to supply the input data and to model the nucleosynthetic environments will be outlined. Suggestions are made as to which nuclear data are most critical for the various scenarios.

6402 Atmospheric Physics

10000 (RAL—86-054) EISCAT observations of plasma lines in the F-region. Horne, R.B. (Rutherford Appleton Lab., Chilton (UK)). Jun 1986. 17p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88750788/JAW.

Results are presented of an experiment to detect simultaneously up-and down-shifted plasma lines using the narrow band receivers at EISCAT. The plasma lines are used to calibrate the electron density and to determine the radar constant. The signal intensities from 226 km altitude indicate an isotropic photoelectron flux with an energy dependent temperature of 3.2 eV. However, the signal intensities from 292 km become highly asymmetric. Simulations are presented to show that this could be the result of an anisotropic photoelectron distribution, or a reception of plasma line signals from another transmitting frequency.

6403 Atomic, Molecular, And Chemical Physics

REFER ALSO TO CITATION(S) 9305, 10157, 10211, 10466

10001 (CONF-8706176—6) Experimental atomic physics in heavy-ion storage rings. Datz, S.; Andersen, L.H.; Briand, J.P.; Liesen, D. (Oak Ridge National Lab., TN (USA); Aarhus Univ. (Denmark). Inst. of Physics; Paris-6 Univ., 75 (France); Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.)). 1987. Contract AC05-84OR21400. 17p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88002674/JAW.

From Workshop and symposium on the physics of low energy, stored, and trapped particles; Stockholm, Sweden (14 Jun 1987).

This paper outlines the discussion which took place at the "round table" on experimental atomic physics in heavy-ion storage rings. Areas of discussion are: electron-ion interactions, ion-ion collisions, precision spectroscopy of highly charged ions, beta decay into bound final states, and atomic binding energies from spectroscopy of conversion elections. 18 refs., 1 tab. (LSP)

10002 (CONF-8710159—5) The structure of small molecules with the Coulomb Explosion method. Vager, Z.; Kanter, E.P. (Argonne National Lab., IL (USA); Weizmann Inst. of Science, Rehovoth (Israel)). 1987. Contract W-31109-ENG-38. 12p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88003086/JAW.

From 12. international conference on atomic collisions in solids; Okayama, Japan (12 Oct 1987).

The content of this paper is divided into two parts: (1) achievements of the last two years in studying molecular ion structure with the aid of the newly developed Coulomb-Explosion (CE) method, and (2) the understanding of the modern CE data in terms of an invariant density of nuclear coordinates of the studied molecule.

10003 (CONF-8710224—1) Determination of molecular-ion structures through the use of accelerated beams. Gemmell, D.S. (Argonne National Lab., IL (USA)). 1987. Contract W-31109-ENG-38. 6p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE88002960/JAW.

From Meeting on applications of ion beams to solid state physics; Osaka, Japan (9 Oct 1987).

In this talk we report on recent research on molecular-ion structures using fast molecular-ion beams provided by Argonne's 5-MV Dynamitron accelerator. The method has become known as the "Coulomb-explosion" technique. When molecular-ion projectiles travelling at velocities of a few percent of the velocity of light strike a foil, the electrons that bind the molecular projectiles are almost always totally stripped off within the first few Angstroms of penetration into the solid target. This leaves a cluster of bare (or nearly bare) nuclei which separate rapidly as a result of their mutual Coulomb repulsion. This violent dissociation process in which the initial electrostatic potential energy is converted into kinetic energy of relative motion in the center-of-mass, has been termed a "Coulomb explosion." 4 refs., 2 figs.

10004 **(GSI—87-46-Prepr.) Electron-positron pair creation in heavy ion collisions.** Kienle, P. (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.)). Aug 1987. 46p. (CONF-8706234—). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88751009/JAW.

From International school of physics Enrico Fermi: course on trends in nuclear physics; Varenna, Italy (23 Jun 1987).

We review here the status of experiments to study the electron positron pair creation in heavy ion atom collisions at bombarding energies close to the Coulomb barrier. The disentanglement and characterisation of various sources of positrons observed in such collisions are described with a focus on the monoenergetic electron positron pairs observed. They seem to originate from the two-body decay of a family of neutral particles with masses of about 3 m/sub e/ and life times in the range of 6x10/sup -14/s < tau < 10/sup -10/s, produced by high Coulomb fields. First attempts were made to create these particles by resonant Bhabha scattering. First we present some experimental methods for high efficiency positron spectroscopy in heavy ion collisions. Then we describe the discovery of positron creation induced by strong time changing Coulomb fields. (orig./HSI).

10005 **(IAE—4199/1) On the role of Coulomb interaction in the multi-photon ionization process.** Zaretskij, D.F.; Fomichev, S.V. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii). 1985. 16p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88700847/JAW.

A new method for solving the problem on multi-photon ionization with regard to Coulomb interaction in the final state is proposed. Schroedinger equation solution in the continuous spectrum in the electromagnetic wave field is found for one-dimensional case in semi-classical approximation taking into account Coulomb interaction. Probability of multiphoton ionization is calculated. It is shown, that in contrast to the case with a short-operating potential, ionization probability near the threshold has a final value and contains a factor, exponentially depending on the field frequency. 10 refs.

10006 **(INIS-mf—10780) Formation of the atomic pionium.** Mundinger, H.J. (Heidelberg Univ. (Germany, F.R.). Naturwissenschaftlich-Mathematische Gesamtfakultaet). 1987. 108p. (In German). NTIS (US Sales Only), PC A06/MF A01. Order Number DE88751511/JAW.

Pionium is the state of a positive pion and an electron bound by the Coulomb interaction. It belongs to the light hydrogen-like atoms. In this thesis an experiment is described in which for the first time this exotic hydrogen isotope was formed and detected. At the Swiss Institute for Nuclear Research pions with a momentum of 45 MeV/c (E=7.2 MeV) were moderated to energies of some 100 keV. These pions pass a 10 μm thick aluminium foil whereby they capture with a probability of some percent an electron and form pionium. Behind the foil the charged particles are separated by a magnetic field and the neutral atoms trapped on a micro channel plate detector (MCP). From the time of flight between a scintillator immediately in front of the foil and the MCP's the energy of the pionium atoms is determined. In two laterally situated scintillator telescopes the muon from the pion decay is detected and later the decay positron from the muon. This multiple coincidence allows a unique identification of the pionium atoms. During a 4-day measurement 3300 pionium atoms were detected on an area of 44 cm/sup 2/ at the position of the MCP's. This corresponds to a pionium rate of 4.0(4) 10/sup -7/π/sup +/e/sup -//π/sub in/ or about one π/sup +/e/sup -//min. If an isotrope emission distribution of the atoms is supposed directly behind the production foil 2 π/sup +/e/sup -//sec is obtained. The time-of-flight distribution of the atoms agrees with Monte Carlo simulations.

10007 (INIS-mf—11052, pp vp) **Hyperfine interaction in muon atoms.** Mamedov, T.N. (Joint Inst. for Nuclear Research, Dubna, USSR). 1985. NTIS (US Sales Only), PC A19/MF A01. Order Number DE88700667/JAW. (CONF-8509430—).

From International summer school on hyperfine interactions and international study meeting: physics with oriented nuclei; Bechyne, Czechoslovakia (2 Sep 1985).

10008 (INIS-mf—11054, pp 62) **Quantum-defect-theoretical wave functions.** Ziegelbecker, R.; Windholz, L.; Schnizer, B. (Technische Univ., Graz, Austria; Technische Univ., Graz, Austria. Inst. fuer Theoretische Physik und Reaktorphysik). Sep 1987. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88700772/JAW. (CONF-8709196—).

From Annual convention fo the Austrian Physical Society; Vienna, Austria (21 Sep 1987).

10009 (INIS-mf—11054, pp 63) **Identification of neon Stark levels by a nomenclature derived from quantum-mechanical calculations.** Ziegelbecker, R.; Jaeger, H.; Windholz, L.; Schnizer, B. (Technische Univ., Graz, Austria; Technische Univ., Graz, Austria. Inst. fuer Theoretische Physik und Reaktorphysik). Sep 1987. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88700772/JAW. (CONF-8709196—).

From Annual convention fo the Austrian Physical Society; Vienna, Austria (21 Sep 1987).

10010 (INIS-mf—11054, pp 63) **Calculation of hyperfine structure changes in external fields .** Musso, M. (Technische Univ., Graz, Austria). Sep 1987. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88700772/JAW. (CONF-8709196—).

From Annual convention fo the Austrian Physical Society; Vienna, Austria (21 Sep 1987).

10011 (INIS-mf—11054, pp 64) **Hyperfine-structure components of sodium D-lines under electric and magnetic fields.** Musso, M.; Windholz, L. (Technische Univ., Graz, Austria). Sep 1987. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88700772/JAW. (CONF-8709196—).

From Annual convention fo the Austrian Physical Society; Vienna, Austria (21 Sep 1987).

10012 (INIS-mf—11054, pp 64) **Fine- and hyperfine structure of lithium resonance lines.** Windholz, L.; Pfeifer, G.; Zerza, G. (Technische Univ., Graz, Austria). Sep 1987. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88700772/JAW. (CONF-8709196—).

From Annual convention fo the Austrian Physical Society; Vienna, Austria (21 Sep 1987).

10013 (INIS-mf—11054, pp 61) **Electron capture and correlation effects in collisions of doubly charged noble gas ions with neutral atoms.** Schweinzer, J.; Jellen-Wutte, U.; Vanek, W.; Aumayr, F.; Winter, H. (Technische Univ., Vienna, Austria. Inst. fuer Allgemeine Physik). Sep 1987. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88700772/JAW. (CONF-8709196—).

From Annual convention fo the Austrian Physical Society; Vienna, Austria (21 Sep 1987).

10014 (INIS-mf—11054, pp 61) **Effects of molecular orbit formation in ion-induced k-shell ionization.** Benka, O.; Geretschlaeger, M.; Paul, H. (Johannes Kepler Univ., Linz, Austria. Inst. fuer Experimentalphysik). Sep 1987. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88700772/JAW. (CONF-8709196—).

From Annual convention fo the Austrian Physical Society; Vienna, Austria (21 Sep 1987).

10015 (INIS-SU—425, pp 40-44) **Variational calculation of characteristics of weakly bound rotational-vibrational states of mesic molecules ddμ and dtμ.** Vinitskij, S.I.; Korobov, V.I.; Puzynin, I.V. 1985. (In Russian). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88780037/JAW. (JINR-N—19-86).

In JINR rapid communications. Collection.

Variational calculations of energy levels of /sup ϵ/2 and γ-factors of weakly bound states (J=1, V=1) of mesic molecules ddμ

and dtμ, which are of main interest for muon-catalyzed fusion, are performed. The set of ~ 1500 basic functions has been used in calcultions which has enabled to obtain the most precise results: ϵ/sub 11/(ddμ)=-1.9749 +- 0.0002 eV, ϵ/sub 11/(dtμ)=-0.663 +- 0.002 eV.

10016 **(INIS-SU—425) JINR rapid communications. Collection.** (Joint Inst. for Nuclear Research, Dubna (USSR)). 1985. 59p. (In Russian). (JINR-N—19-86). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88780037/JAW.

Individual papers have been cataloged separately. (WRF)

10017 **(IPNO-DRE—87-01) Stopping powers of solids for /sup 16/O ions at intermediate energies (20-95 MeV/u).** Gauvin, H.; Bimbot, R.; Herault, J.; Anne, R.; Bastin, G.; Hubert, F. (Paris-11 Univ., 91 - Orsay, France. Institut de Physique Nucleaire; G.A.N.I.L., 14 - Caen, France; C.S.N.S.M., 91 - Orsay, France; Bordeaux-1 Univ., 33 -Gradignan, France. Centre d'Etudes Nucleaires). (Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire). 1987. 16p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88751617/JAW.

The stopping powers of 11 solid media have been measured for 20-95 MeV/u oxygene ions from the French GANIL accelerator. The energy measurements were made using the LISE magnetic spectrometer. The accuracy in stopping power determinations is of +- 1-2%. The data are in good agreement with semi-empirical values from Hubert et al (Ann. Phys. Fr. 5, supp (1980)) and from Ziegler (Pergamon, 1980) and with a scaling relative to He/sup 2+/ ion stopping powers, assuming fully stripped ions inside the degrader.

10018 **(ITEP—158-1985) Zel'dovich effect in quantum mechanics.** Karnakov, B.M.; Mur, V.D.; Kudryavtsev, A.E.; Popov, V.S. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1985. 39p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88700458/JAW.

In systems bound by the Coulomb potential with a short-range distortion, the reconstruction of atomic spectrum (or Zel'dovich effect) can appear. Some peculiarities of this phenomenon for the state of nonzero angular momentum are discussed. Analytical properties of the basic equation in the presence of absorption are investigated. The values of absorption at which the reconstruction of atomic levels is replaced by oscillation regime are given. Some applications of the Zel'dovich effect for hadronic atoms and mesomolecules are considered. 44 refs.; 7 figs.; 2 tabs.

10019 **(JINR-E—4-86-705) Negative-energy quanta.** Shirokov, M.I. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1986. 16p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88700904/JAW.

Submitted to the journal Zh. Ehksp. Teor. Fiz. .

The effect of the retarded action of an unexcited atom A on an excited atom D is revealed by means of QED calculation. The electromagnetic field emitted by A and later absorbed by D cannot consist of photons because quanta of the field must have a negative energy. It is argued that there exist also negative-energy quanta of other fields, e.g., the fermionic ones. The appropriate experiment and consequences of the existence of these quanta are discussed. 11 refs.

10020 **(PPPL—2477) Collisional processes of hydrocarbons in hydrogen plasmas.** Ehrhardt, A.B.; Langer, W.D. (Princeton Univ., NJ (USA). Plasma Physics Lab.). Sep 1987. Contract AC02-76CH03073. 95p. NTIS, PC A05/MF A01; 1; GPO Dep. Order Number DE88003462/JAW.

We have investigated the reactions of methane and its derivatives with hydrogen plasmas for use in modelling carbon and hydrocarbon transport in hydrogen plasmas. We provide quantitative information over the temperature range from 0.1 eV to 2 keV for the most significant reactions of methane and methane fragments with electrons and protons. We review the properties of each reaction, present graphs of the cross section and reaction rate coefficient, and give analytical fits for σ and [σv]. 34 refs.

10021 **(PPPL—2484) Observation of asymmetric Stark profiles from plasmas created by a picosecond KrF laser.** Nam, C.H.; Tighe, W.; Suckewer, S.; Seely, J.F.; Feldman, U.; Woltz, L.A. (Princeton Univ., NJ (USA). Plasma Physics Lab.; Hulbert (E.O.) Center for Space Research, Washington, DC (USA); National Bureau of Standards, Washington, DC (USA). Center for Radiation Research). Oct 1987. Contract AC02-76CH03073. 16p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88003449/JAW.

High-resolution extreme ultraviolet (XUV) spectra from solid targets irradiated by a picosecond KrF^* laser focused to 10^{16} W/cm^2 have been recorded. The line profiles of transitions in Li-like fluorine and oxygen are asymmetric and up to 2 A in width. Calculations indicate the presence of transitions of the type 2p-3p and other forbidden Stark components. 11 refs., 6 figs.

10022 **(RAL—86-052) CODES: a COllimation DESign program for neutron beam lines.** Howells, W.S. (Rutherford Appleton Lab., Chilton (UK)). May 1986. 15p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88750760/JAW.

CODES is an interactive computer program to aid collimation design of beam lines on a pulsed neutron source. Instructions for operating the program are presented, together with examples of running.

10023 **(RAL—86-062) Electron excitation of atoms by neutron-nucleus scattering: dipole approximation.** Lovesey, S.W. (Rutherford Appleton Lab., Chilton (UK)). Jun 1986. 4p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88750784/JAW.

The matrix element for recoil-induced excitation of an electron, bound in a hydrogenic atom, by neutron scattering is reported. The result is correct to leading-order in the neutron scattering wave vector. The off-diagonal matrix element is expressed in terms of a radial integral tabulated by Condon and Shortley, and the total probability for excitation is deduced from the square of the diagonal element.

10024 **(UCRL—96936) Practical applications of coherent transition radiation.** Moran, M.J. (Lawrence Livermore National Lab., CA (USA)). 2 Oct 1987. Contract W-7405-ENG-48. 15p. (CONF-8710159—3). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88002574/JAW.

From 12. international conference on atomic collisions in solids; Okayama, Japan (12 Oct 1987).

The predictable nature of transition radiation (TR) emissions has been demonstrated under a wide variety of experimental conditions. The reliable character of TR allows the design of specific practical applications that use emissions from the optical to the x-ray spectral regions. Applications often can be enhanced by the spatial coherence of TR, and some have become highly developed. New applications may be developed through the use of other related radiation mechanisms. 20 refs., 3 figs.

10025 **(UCRL—97530) Intense electron beams.** Yu, S.S. (Lawrence Livermore National Lab., CA (USA)). 20 Oct 1987. Contract W-7405-ENG-48. 11p. (CONF-8710228—1). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88002456/JAW.

From US-CERN topical course on frontiers of particle beams; South Padre Island, TX, USA (23 Oct 1987).

This paper is concerned with intense electron beams, typically of the order of a few kA in current and up to tens of MeV in beam energy. A beam of this kind can be produced from induction machines, examples of which are the ERA (4 MeV, 1 kA) at Lawrence Berkeley Laboratory and the ASTRON (5 MeV, 500A), ETA (5 MeV, 10 kA), and ATA (50 MeV, 10 kA) at Lawrence Livermore National Laboratory (LLNL). The emphasis of the paper is on the characteristics of these beams and some applications. 13 refs., 2 figs. (LSP)

6404 Fluid Physics

REFER ALSO TO CITATION(S) 9987

10026 **(CONF-870664—4) The application of liquid-metal MHD [magnetohydrodynamics] to renewable energy sources.** Berry, G.F.; Petrick, M.; Pierson, E.S.; Sukoriansky, S. (Argonne National Lab., IL (USA); Purdue Univ., Hammond, IN (USA); Ben-Gurion Univ. of the Negev, Beersheba (Israel)). 1987. Contract W-31109-ENG-38. 11p. NTIS, PC A03. Order Number DE88003083/JAW.

From 25. symposium on engineering aspects of magnetohydrodynamics; Bethesda, MD, USA (24 Jun 1987).

A system study of the OMACON liquid-metal MHD conversion technology was undertaken for SCE to define the potential gains that could be derived from the use of the technology in selected utility applications. Four applications studied were: (1) the solar power tower; (2) a medium temperature solar system employing line focus collectors; (3) geothermal power systems; and (4) an Integrated Coal-Gasifier Combined Cycle plant. Computer simulations were developed for each of the system applications and used to calculate thermodynamic performance; the computer simulations were also used to evaluate sensitivity of system performance to key component efficiencies and operating parameters. The computer simulations accounted for all known first-order loss mechanisms. Only the solar power tower and geothermal power system are presented in this paper.

10027 **(CONF-8708158—2) Quasiparticle, natural, and mean-field orbitals in drops of liquid helium.** Pieper, S.C. (Argonne National Lab., IL (USA)). 1987. Contract W-31109-ENG-38. 10p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE88002975/JAW.

From 5. international conference on the recent progress in the many-body theories; Oulu, Finland (3 Aug 1987).

In the last few years we have used the variational Monte Carlo (VMC) technique to find accurate ground-state wave functions for drops of liquid helium containing 8 to 728 ^{4}He atoms (Bose statistics) or 40 to 240 ^{3}He atoms (Fermi statistics). The wave functions include both two- and three-particle correlations. From comparisons with GFMC results, we believe these wave functions to be among the most accurate for systems of approximately 100 strongly interacting particles. Having determined the wave functions, we can use them to investigate the properties of the quantum-mechanical ground states of large finite systems. In previous studies we have investigated the accuracy of local-density approximations (LDA) for the pair-correlation function and have studied the structure functions of the drops and their relationships to two-particle correlations. The present report is principally devoted to a recent study of single-particle orbitals in the drops.

10028 **(SAND—87-2637C) Boundary integral analysis of flow and deformation of long bubbles in capillaries.** Martinez, M.J.; Udell, K.S. (California Univ., Berkeley (USA). Dept. of Mechanical Engineering). 1987. Contract AC04-76DP00789. 5p. (CONF-871234—4). NTIS, PC A02. Order Number DE88002110/JAW.

From ASME winter meeting; Boston, MA, USA (13 Dec 1987).

A boundary integral analysis of the creeping motion of a long inviscid bubble in a liquid-filled tube is presented. The effects of interfacial surface tension are included in the stress balance across the liquid-bubble interface. Velocities, stresses and the bubble profile are obtained as a function of the capillary number. Computed values of the thickness of the liquid film between the bubble and tube wall are in excellent agreement with published experimental measurements. The results are of interest in exposing the role of surface tension in multiphase flow in capillary tubes and porous materials. 13 refs., 8 figs.

10029 **Remarks on the clump theory.** Krommes, J.A. (Princeton Univ., Plasma Physics Lab., P.O. Box 451, Princeton, NJ 08544). pp 226-240 of Statistical plasma physics: Proceedings of Workshop of US-Japan joint institute for fusion theory program. Nagoya, Japan; Institute of Plasma Physics (1986). (CONF-8602116—).

From US/Japan workshop on statistical plasma physics; Nagoya, Japan (17 Feb 1986).

Further details are provided of a recently published dialog which discussed the role of the small scales in fluid clump theory. It is argued that the approximation of the clump lifetime which is compatible with exponentially rapid separation of adjacent orbits is inappropriate for the description of dynamically important large scales. Various other remarks are made relating to analytic treatment of strong drift-wave-like turbulence.

10030 **Plasma distribution function in a superthermal radiation field.** Hasegawa, A.; Mima, K.; Duong-van, M. (AT and T Bell Labs., Murray Hill, NJ 07974). pp 356-358 of Statistical plasma physics: Proceedings of Workshop of US-Japan joint institute for fusion theory program. Nagoya, Japan; Institute of Plasma Physics (1986). (CONF-8602116—).

From US/Japan workshop on statistical plasma physics; Nagoya, Japan (17 Feb 1986).

A plasma which is immersed in superthermal radiation suffers velocity-space diffusion which is enhanced by the photon-induced Coulomb-field fluctuations. This enhanced diffusion universally produces a power-law distribution (E/E/sub O//sup -κ/ at energy E larger than a critical energy E/sub O/ where the transition energy E/sub O/ and the power κ are inversely proportional to the photon-field intensity.

6450 High Energy Physics

REFER ALSO TO CITATION(S) 9987, 10016, 10365, 10628

6451 Particle Interactions And Properties - Experimental

REFER ALSO TO CITATION(S) 9392, 10117, 10165, 10223

10031 **(ANL-HEP-CP—86-57) Production and fragmentation of the D^{*0} meson in e^+e^- annihilation at $\sqrt{s}$ = 29 GeV.** Abachi, S.; Akerlof, C.; Baringer, P.; Blockus, D.; Brabson, B.; Brom, J.M.; Bylsma, B.G.; Chapman, J.; Cork, B.; Debonte, R. (Argonne National Lab., IL (USA); Indiana Univ., Bloomington (USA); Lawrence Berkeley Lab., CA (USA); Michigan Univ., Ann Arbor (USA); Purdue Univ., Lafayette, IN (USA)). Jun 1986. Contract W-31109-ENG-38. 15p. (CONF-860701—92). NTIS, PC A03. Order Number DE88002910/JAW.

From 23. international conference on high-energy physics; Berkeley, CA, USA (16 Jul 1986).

The production properties of the D^{*0} have been studied in e^+e^- annihilations at $\sqrt{s}$ = 29 GeV using the High Resolution Spectrometer (HRS). The decay of D^{*0} into $D^0\gamma$ and $D^0\pi^0$, where D^0 decays into $K^-\pi^+$, was observed. The production cross section and fragmentation function are compared with those of the D^{*+} meson measured in the same experiment. The branching ratio for D^{*0}-$D^0\gamma$ is measured to be 0.53 +- 0.22.

10032 **(BNL—40379) Weak neutral currents and future Z mass measurements: Anticipating SLC.** Marciano, W.J. (Brookhaven National Lab., Upton, NY (USA)). Sep 1987. Contract AC02-76CH00016. 20p. (CONF-870821—1). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88002118/JAW.

From SLAC summer institute on particle physics; Stanford, CA, USA (10 Aug 1987).

The goals of this work are: to test the standard SU(2)/sub L/ x U(1) model at the tree and quantum loop level, provide a precise determination of $\sin^2\theta$/sub W/ which could, for example, be used to rule out or at least constrain various grand unified theories (GUTS), and look for hints of "new physics." The topics this paper elaborates on are radiative corrections, top quark mass bounds, grand unified theories (GUTS), and extra Z' boson constraints. In addition, the implications of a precise Z boson mass determination at SLC would have when combined with existing neutral current data is examined. 21 refs., 3 figs., 3 tabs. (LSP)

10033 **(CALT—63-479) Properties of nuclei and elementary particles at low and intermediate energies: Progress report, May 1985-August 1986.** Boehm, F. (California Inst. of Tech., Pasadena (USA). Norman Bridge Lab. of Physics). 1986. Contract AS03-81ER40002. 74p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE88001913/JAW.

In this paper we report on a search for neutrino oscillations performed at the nuclear power reactor in Goesgen (Switzerland). The energy spectra of the electron antineutrinos emerging from the reactor core have been measured at distances of $L_1 = 37.9$ m (experiment 1), $L_2 = 45.9$ m (experiment 2) and $L_3 = 64.7$ m (experiment 3). The measured spectra are analyzed in terms of a two-neutrnio oscillation model. Two analyses are presented: (A) the first is based exclusively on a comparison of the measured spectra obtained at the three distances L/sub j/. This analysis is essentially independent of any external assumptions concerning the reactor antineutrino spectrum, the detection cross section and the detector efficiency; (B) the second analysis includes the reactor antineutrino spectrum as derived from independent β-spectroscopic measurements. This procedure increases our sensitivity to the oscillation parameters. 29 refs., 13 figs., 5 tabs.

10034 **(DOE/ER/03956—6) Elementary particle interactions: Progress report, October 1, 1986-September 30, 1987.** Bugg, W.M.; Brau, J.E.; Condo, G.T.; Handler, T.; Hart, E.L. (Tennessee Univ., Knoxville (USA). Dept. of Physics). Oct 1987. Contract AS05-76ER03956. 41p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88002427/JAW.

This paper discusses the experimental work done at the University of Tennessee on the following topics: photoproduction, tevatron neutrino interaction, small angle electromagnetic calorimetry for the Stanford Linear Detector, and detectors for the superconducting super collider. (LSP)

10035 **(IFVE-ONF—86-209) Rapidity dependence of all charged and negatively charged particle multiplicities in non-diffraction π/sup +/p and pp collisions at 250 Gev/c.** Adamus, M.; Azhinenko, I.V.; Belokopytov, Yu.A. and others. (Warsaw Univ., Poland; Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1986. 9p. (In Russian). (CERN-NA—22). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88700865/JAW.

Multiplicity distributions of all charged and negatively charged particles for non-diffraction events in π/sup +/p and pp-collisions at 250 GeV/c ($\sqrt{s}$=22 GeV) are presented for various rapidity intervals. The data are well described by the negative binomial distribution. The parameters of these distributions for the π/sup +/p and pp and are different for full phase space, but similar for the central region. In the central region, the relation k/sub ch/ ~ 1/2k/sub -/ holds for all charged and negative multiplicities. This favours to the interpretation in terms of cascade models rather than stimulated emission models. 12 refs.; 2 figs.

10036 **(IFVE-ONF—86-221) Study on the νn -> μ/sup -/p and ν-barp-> μ/sup +/n quasi-elastic reactions in the SCAT bubble chamber at 3-20 GeV.** Grabosch, H.J.; Kaufmann, H.H.; Krecker, U. (Akademie der Wissenschaften der DDR, Berlin-Zeuthen. Inst. fuer Hochenergiephysik). (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1986. 8p. (In Russian). (SERP-E—107). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88700866/JAW.

Submitted to the journal Yad. Fiz. .

The paper presents the total and differential cross sections of the νn -> μ/sup -/p and ν-barp -> μ/sup +/n quasi-elastic reactions at neutrino energies of 3-20 GeV. The data are obtained from the exposure of the SCAT chamber filled with freon at the Serpukhov accelerator neutrino channel. The results are compared with V-A theory. Within dipole approximation a value has been obtained for the axial mass M/sub A/=(0.96 +- 0.04 +- 0.14) GeV and M/sub A/=(0.72 +- 0.11 +- 0.020) GeV for ν and ν-bar data respectively. 23 refs.; 2 figs.

10037 **(IFVE-OTF—86-47) Extended gauge symmetry as a possible source of exotic events.** Borisov, G.V.; Pirogov, Yu.F.; Sultanov, S.F. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1986. 19p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88700397/JAW.

Submitted to the journal Sov. J. Nucl. Phys. .

The SPS exotic events with large missing transverse momenta pp-bar -> j(s)ep/sub t//sup (miss)/; j(s)p/sub t//sup (miss)/ are described in the framework of an extended gauge symmetry due to the production of a heavy gauge boson V of mass ~ 180 GeV/c/sup 2/ and its subsequent decay in the channel q-barQ/sub -> qW(Z)/, (Q being a heavy quark of mass ~ 100 GeV/c/sup 2/, and then as W -> eν-bar(Z -> $\nu\nu$-bar). 11 refs.; 6 figs.

10038 **(INIS-mf—10751) Inclusive K/sup n/, Λ, and anti Λ production and analysis of the polarization in a K/sup -/p experiment at a K/sup -/ incident momentum of 110 GeV/c.** Goettgens, R.M.J. (Technische Hochschule Aachen (Germany, F.R.). Mathematisch-Naturwissenschaftliche Fakultaet). 8 Feb 1985. 113p. (In German). NTIS (US Sales Only), PC A06/MF A01. Order Number DE88751025/JAW.

By means of a K/sup -/ beam at the highest momentum of 110 GeV/c hitherto reached by the RF method a K/sup -/p bubble chamber experiment was performed. Thereby inclusive K/sup n/, Λ, and anti Λ cross sections were determined as well as their differential distributions studied and compared with experimental data at lower energies. Furthermore the polarization was analyzed as function of the Feynman x and of the transverse momentum and compared with two theoretical models as well as with measurement results of other experiments. (orig./HSI).

10039 **(INIS-mf—10752) Measurement of the inclusive spectra of π/sup 0/ and eta mesons in the energy range of the Y resonances with the ARGUS detector.** Drescher, A. (Dortmund Univ. (Germany, F.R.). Inst. fuer Physik). 13 Feb 1987. 87p. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88751026/JAW.

In the framework of this thesis the inclusive π/sup 0/ and eta spectra from decays of Y resonances as well as from e/sup +/ e/sup -/ events in the continuum at 10.4 GeV were measured. eta spectra could for the first time be measured both from gluonic decays of the Y(1S) meson and from qanti q reactions in the continuum over a wide z range. Both the π/sup 0/ and the eta distribution agree in the framework of their measurement errors well with the predictions of the LUND fragmentation model and the parton shower model of Webber whereby they prefer at high z values the former slightly. From the spectra the production rates of π/sup 0/ and eta mesons in hadronic events were determined. Because especially at eta mesons high momenta it can be assumed that they result from primary partons by this differences between the fragmentation of gluons and quarks can be studied. The ratio of the mean eta multiplicity in 3-gluon decays to that in continuum events is compatible in the framework of the measurement errors with 1. The same is valid for π/sup 0/ mesons although this statement has lower weight because those result with essentially lower frequency from the direct fragmentation chain but are more frequently the decay products of heavy hadrons. The measured eta multiplicities are in contradiction to a model of the gluon fragmentation of Peterson and Walsh which predicts a drastically increased production of isoscalar neutral particles in gluon jets in comparison to quark jets. This model could by this be distinctly disproved. (orig./HSI).

10040 **(INIS-mf—10753) Measurement of the inclusive spectra of PHI mesons in the energy range of the Y resonances with the ARGUS detector.** Matthiesen, U. (Dortmund Univ. (Germany, F.R.). Inst. fuer Physik). 6 Mar 1987. 124p. (In German). NTIS (US Sales Only), PC A06/MF A01. Order Number DE88751027/JAW.

In this thesis the production of PHI mesons in decay of the resonances Y(1s), Y(2s), and Y(4s) as well as in events in the continuum was studied. The spectra which result from the measurements in the continuum and the direct decays of the Y(1s) were

compared with predictions on PHI production in the quark respectively gluon fragmentation according to the Lund and the Webber model. It was shown that in both models too many PHI mesons are produced which can partly explained by overestimation of the contribution to PHI production from decays of charm-containing resonances. On the other hand these models also in gluonic decays of the Y(1s) predict too many PHI mesons whereby the production of charm quarks and by this the PHI production from resonance decays is impossible. This suggests that especially in the LUND program the ratio of V:P is overestimated with 1.5:1. From the measured inclusive spectra the mean PHI multiplicities were determined. The rate ratio for the PHI production on the Y(1s) resonance and in the continuum is very well compatible with the generally slight increasing of the particle multiplicity in decays of the Y(1s). Because of the high precision of the data presented in this theses can be concluded that the contrarily to the meson rate in the decay of the Y(1s) into three gluons observed increased baryon rate is a characteristicum of the baryon production and not as earlier suggested only a mass effect. Finally the PHI rate ratio was compared with predictions of the Peterson-Walsh model from which a strong increasement of the production of isoscalar mesons in gluon jets against that in quark jets follows. The incompatibility between model and measurement is so large that the model must be regarded as disproved. (orig./HSI).

10041 (INIS-mf—11052, pp vp) **PPT experiments in JINR.** Kazarinov, Yu.M. (Joint Inst. for Nuclear Research, Dubna, USSR). 1985. NTIS (US Sales Only), PC A19/MF A01. Order Number DE88700667/JAW. (CONF-8509430—).

From International summer school on hyperfine interactions and international study meeting: physics with oriented nuclei; Bechyne, Czechoslovakia (2 Sep 1985).

A review is given of experiments with the polarized proton target in the Laboratory Nuclear Problems at JINR Dubna. The experiments were carried out using the accelerators in Dubna, Gatchina and Serpukhov in 1970-1985. The mathematical formalism of NN and πN scattering is explained. Described are the measurements of C/sub NN/ in pp elastic scattering at 590-950 MeV, depolarization in pp and np elastic scattering at 600-650 MeV, polarization and R parameter in πp, Kp, pp and anti-p p elastic scattering at 40 GeV/c and polarization in the charge exchange scattering at 40 GeV/c. (Z.J.).

10042 (INIS-mf—11052, pp vp) **Collisions of polarized neutrons on polarized protons at 14.5 MeV.** Formanek, J.; Wilhelm, I. (Karlova Univ., Prague, Czechoslovakia. Fakulta Matematicko-Fyzikalni). 1985. NTIS (US Sales Only), PC A19/MF A01. Order Number DE88700667/JAW. (CONF-8509430—).

From International summer school on hyperfine interactions and international study meeting: physics with oriented nuclei; Bechyne, Czechoslovakia (2 Sep 1985).

Information is presented on an experiment being prepared to study the elastic scattering of polarized neutrons on polarized protons at a neutron energy of 14.5 MeV. The polarized neutrons will be obtained using reaction d+t->n+/sup 4/He. The polarized proton target is made of C/sub 3/H/sub 8/O/sub 2/. The experiment will be performed in cooperation with JINR Dubna at the Van de Graaff accelerator of the Faculty of Mathematics and Physics of the Charles University in Prague. (Z.J.).

10043 (INIS-mf—11052, pp vp) **Experimental study of n-p scattering amplitudes at low energy.** Wilhelm, I. (Karlova Univ., Prague, Czechoslovakia. Fakulta Matematicko-Fyzikalni). 1985. NTIS (US Sales Only), PC A19/MF A01. Order Number DE88700667/JAW. (CONF-8509430—).

From International summer school on hyperfine interactions and international study meeting: physics with oriented nuclei; Bechyne, Czechoslovakia (2 Sep 1985).

10044 (INIS-mf—11054, pp 40) **Physical objective of the DELPHI experiment.** Adam, W.; Bartl, W.; Fruehwirth, R.; Hrubec, J.; Leder, G.; Mandl, F.; Mitaroff, W.; Pernicka, M.; Regler, M. (Oesterreichische Akademie der Wissenschaften, Vienna. Inst. fuer Hochenergiephysik). Sep 1987. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88700772/JAW. (CONF-8709196—).

From Annual convention fo the Austrian Physical Society; Vienna, Austria (21 Sep 1987).

10045 (INIS-mf—11054, pp 39) **Two-particle correlation function in 360 GeV/c pp-reactions.** Buschbeck, B.; Dibon, H.; Hrubec, J.; Lipa, P.; Macnaughton, J.; Markytan, M.; Porth, P. (Oesterreichische Akademie der Wissenschaften, Vienna. Inst. fuer Hochenergiephysik). Sep 1987. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88700772/JAW. (CONF-8709196—).

From Annual convention fo the Austrian Physical Society; Vienna, Austria (21 Sep 1987).

10046 (INIS-mf—11054, pp 74) **Strangeness-, charme-, and bottom particles in the pp reactions at the UA1-detector.** Markytan, M. (Oesterreichische Akademie der Wissenschaften, Vienna. Inst. fuer Hochenergiephysik). Sep 1987. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88700772/JAW. (CONF-8709196—).

From Annual convention fo the Austrian Physical Society; Vienna, Austria (21 Sep 1987).

10047 (INIS-mf—11065) **Determination of the neutral current chiral coupling constants u/sub 1//sup 2/, u/sub r//sup 2/, d/sub 1//sup 2/, and d/sub r//sup 2/ from an (anti)neutrino-deuterium experiment.** Eijndhoven, N.J.A.M. van. (Amsterdam Univ. (Netherlands)). 1 Jul 1987. 126p. NTIS (US Sales Only), PC A07/MF A01. Order Number DE88700879/JAW.

Includes summary in Dutch.

The results of an analysis of neutrino and anti-neutrino interactions on deuterium are presented. Deuterium has been chosen as target material because it provides a means to study interactions on protons and neutrons separately within the same experimental setup. The data were taken with the Big European Bubble Chamber (BEBC) which was extended with an Internal Picket Fence (IPF) and an External Muon Identifier (EMI), and the data processing was performed by the WA25 collaboration. The various neutral current/charged current ratios are presented. Using these ratios, the individual chiral coupling constants are determined with high accuracy. The results are found to agree very well with the predictions of the standard SU(2)/sub L/ X U(1)/sub y/ model. 75 refs.; 68 figs.; 12 tabs.

10048 (INIS-mf—11074) **Particle production in hadron-proton interactions at 250 GeV/c incident beam momentum.** Hal, P.A. van. (Katholieke Univ. Nijmegen (Netherlands)). 19 Feb 1987. 162p. NTIS (US Sales Only), PC A08/MF A01. Order Number DE88700880/JAW.

Includes summary in Dutch.

In this theais several characteristic properties are described of π/sup +/p, K/sup +/p and pp collisions at an incident beam momentum of 250 GeV/c, and compared to characteristics of other energy. The experiment has been performed in the European Hybrid Spectrometer (EHS) exposed to a tagged meson enriched beam. The rapid cycling bubble-chamber and the other detector elements which comprise EHS are described in Ch. 2. Events used for the analysis have been scanned, measured and merged with the electronic counter information. After the merge steps the data have been processed through a chain of reconstruction programs (Ch. 3). In Ch. 4 the multiplicity distributions and topological cross sections are presented. An introduction to the models (Monte Carlo programs) is given in Ch. 5. In Ch. 6 the characteristics of charged particle production in π/sup +/p, K/sup +/p and pp collisions at 250 GeV/c are presented. In Ch. 7 the forward π/sup 0/ production is presented, a study of rho and omega resonance production in the forward hemisphere in Ch. 8. In Ch. 6, 7 and 8, the data are

compared to predictions from the Monte Carlo programs described in Ch. 5. 117 refs.; 70 figs.; 23 tabs.

10049 (INIS-SU—425, pp 6-15) **Polarization of γ/sup -/ produced inclusively by neutrons.** Aleev, A.N.; Aref'ev, V.A.; Balandin, V.P. 1985. (In Russian). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88780037/JAW. (JINR-N—19-86).

In JINR rapid communications. Collection.

Polarization of γ/sup -/ produced inclusively by neutrons with 40 GeV/c mean momentum has been measured in an experiment performed using the BIS-2 sectrometer at the Serpukhov accelerator. γ/sup -/ have been accepted in a kinematic region of 0<P/sub T/<1.3 GeV/c at <X> = 0.45 and are polarized negatively (0.3 +- 0.2) along the normal to the production plane which is defined by a vector product of neutron and γ/sup -/ momenta in the lab. coordinate system. The γ/sup -/ -> Λ/sup 0/ π/sup -/ decay asymmetry parameter has been measured as well: (α<γ/sup -/)=(0.48 +- 0.16). The γ/sup -/ polarization measured is in agreement with the Λ/sup 0/ polarization obtained in this experiment and with the polarization of γ/sup -/ produced by 400 GeV protons, but is opposite in sign to the polarization of γ/sup -/ produced by 5 GeV negative kaons.

10050 (INIS-SU—425, pp 16-23) **Observation of U(3100) in BIS-2 experiments.** Aleev, A.N.; Aref'ev, V.A.; Balandin, V.P. 1985. NTIS (US Sales Only), PC A04/MF A01. Order Number DE88780037/JAW. (JINR-N—19-86).

In JINR rapid communications. Collection.

A meson resonance U(3100) with negative strangeness, produced in neutron-nucleus interactions at a mean neutron momentum of ~ 40 GeV/c, has been observed in experiments performed by means of the BIS-2 spectrometer at the Serpukhov accelerator. Carbon, aluminium and copper were used as nuclear targets. Altogether ~ 180 decays of four different states of this resonance into Λ/sup 0/ + π-bar + nxπ/sup +-/ and K/sub s//sup 0/ + p + p-bar + π/sup +/ have been registered. The isotopic spin of the resonance is equal to 3/2. The resonance production cross section in the region X > 0.2 times the branching ratio of its decay via each observed mode is from 1 to 20 μb per cardon nucleus. The A-dependence of the resonance production cross section is described by the power law A/sup α/ with α=0.6 +- 0.3.

10051 (INS—631) **Alternatively possible neutrino oscillation in the neutrino burst from SN1987A.** Midorikawa, S.; Terazawa, H.; Akama, K. (Tokyo Univ., Tanashi (Japan). Inst. for Nuclear Study). Jun 1987. 16p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88751045/JAW.

The periodic structure found in the observed spectrum of inverse electron neutrino energies of the KAMIOKANDE-II and IMB data on the neutrino burst from the supernova SN1987A, which can be most simply explained by possible neutrino oscillation in vacuum with the extremely small mass-squared difference of Δm/sup 2/ = (7.2 +- 0.4) x 10/sup -20/ eV/sup 2/, can also be explained by neutrino oscillation in the supernova or in the earth. By comparing the data with our model calculations including the Mikheyev-Smirnov-Wolfenstein effect, the mass-squared difference of neutrinos is estimated to be Δm/sup 2/ = (2.0 +- 0.5) x 10/sup -7/ (R/R/sub s/)eV/sup 2/ or (2.5 +- 0.9) x 10/sup -5/ eV/sup 2/.

10052 (ITEF—67(1985)) **Cross sections of different channels of strange particle production in the π/sup -/p interactions at 4.5 GeV/c.** Aleshin, Yu.D.; Arutyunyants, G.A.; Kiselevich, I.L.; Kulakov, V.P.; Mel'nichenko, I.A.; Moskalev, V.I.; Shidlovskij, A.V.; Shkarpet, V.D. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1985. 12p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88700888/JAW.

Cross sections of the following exclusive reactions: π/sup -/p -> ΛK/sup 0/, Σ/sup 0/K/sup 0/, ΛK/sup 0/π/sup 0/, ΛK/sup +/π/sup -/, Σ/sup 0/K/sup +/π/sup -/, Λπ/sup -/K*/sup +/(K*/sup +/ -> K/sup 0/π/sup +/), ΛK/sup 0/π/sup +/π/sup -/, ΛK/sup +/π/sup -/π/sup 0/, Σ/sup 0/K/sup 0/π/sup +/π/sup -/, pK/sup 0/K/sup -/, pK/sup 0/K/sup -/π/sup 0/, nK/sup +/π/sup 0/π/sup -/, nK/sup -/K/sup 0/π/sup +/ and of the following inclusive reactions: π/sup -/p -> ΛK/sup 0/ + Z/sup 0/, ΛK/sup +/π /sup -/ + Z/sup 0/, 2K/sup 0/ + X, 2K/sup 0/ + Z/sup 0/, 2K/sub S//sup 0/ + Z/sup 0/, 2K/sub S//sup 0/ + X, ΛK/sup 0/π/sup +/π/sup -/ + Z/sup 0/, pK/sup 0/K/sup -/ + Z/sup 0/, K*/sup +/ + X, K*/sup -/ + X (where Z/sup 0/ are undetectable neutral particles) are obtain ed. The cross sections obtained are compared with the ones k nown in literature. 6 refs.; 21 figs.

10053 (JINR—E-1-86-591) **New results on nuclear effects in deep inelastic muon scattering on deuterium and iron targets.** Benvenuti, A.C.; Bollini, D.; Bruni, G. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1986. 6p. (CONF-860701—). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88700477/JAW.

From 23. international conference on high-energy physics; Berkeley, CA, USA (16 Jul 1986).

New results on the ratio of structure functions F/sub 2/(x,Q/sup 2/) measured in deep inelastic muon scattering on deuterium and iron targets at large four-momentum transfer Q/sup 2/ are presented. The ratio F/sub 2//sup Fe/(x)/F/sub 2//sup D(sub 2/(x) is measured in the kinematic range 0.06 ≦ x ≦ 0.70, 14 GeV/sup 2/ ≦ Q/sup 2/ ≦ 70 GeV/sup 2/ and is in good agreement with earlier measurements in the region of x > 0.3. Below x=0.20, the structure function ratio exhibits and enhancement of ~ 5%. 6 refs.; 4 figs.

10054 (JINR—R-1-86-585) **Observation of π/sup 0/π/sup 0/-interference effect and size of π/sup 0/ emission region in π/sup -/Xe-interactions at 3.5 GeV/c.** Grishin, V.G.; Miller, K.; Plyuta, Ya. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy). 1986. 10p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88700498/JAW.

Submitted to the journal Yad. Fiz. .

Results from two-particle correlation studies are presented for π/sup 0/ mesons emitted in π/sup -/-Xe collisions at 3.5 GeV/c momentum. Interference correlations of π/sup 0/ mesons are found. Size of the region is determined, where the π/sup 0/ mesons are emitted from, and the π/sup 0/ generation time is estimated: r=1.2 +- 0.3 fm, ctau=0.8/sub -0.3//sup +0.4/ fm. The results correspond to those obtained in hadron-hadron collisions, but the values of r and ctau smaller than those for nucleus-nucleus collisions at such energies. 27 refs.; 2 figs.

10055 (JINR—R-1-86-619) **Analysis of π/sup -/p interactions at 5 GeV/c in the framework of the Lund color string model.** Vinogradov, V.B.; Kul'chitskij, Yu.A. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems). 1986. 16p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88700499/JAW.

Submitted to the journal Yad. Fiz. .

In the framework of the Lund colour string model the detailed analysis of the experimental data on π/sup -/p-interactions at 5 GeV/c has been performed. Examples of the discrepancies between the model predictions and the experiment are given. It is shown that for the satisfactory description of the data it is necessary to make some model modification. 49 refs.; 9 figs.

10056 (JINR—R-1-86-640) **Multiplicity distributions of π/sup 0/ mesons in multinucleon CC interactions at 4.2 GeV/c per nucleon.** Gulkanyan, G.R.; Kanarek, T.; Kladnitskaya, E.N.; Korchagin, S.A. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy). 1986. 10p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88700500/JAW.

Submitted to the journal Yad. Fiz. .

The results of reconstruction of the π/sup 0/-meson distributions on the basis of the distributions over the number of registered γ-quanta for multinucleon CC-interactions at 4.2 GeV/c per nucleon are presented. The reconstructed π/sup 0/-meson distributions are compared with the π/sup -/-meson distributions for the same interactions. It has been shown that the π/sup 0/-meson multiplicity distribution has a larger dispersion than the distribution over π/sup -/-meson number. The dependence of the average

number of π/sup 0/-mesons on the π/sup -/-meson number has been found. The experimental results are compared with the cascade model calculations. 12 refs.; 5 figs.

10057 **(JINR—R-1-86-728) Study on the A(d,p)X reactions at 9 GeV/c in the proton large transverse momentum region.** Azhgirej, L.S.; Vzorov, I.K.; Zhmyrov, V.N. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Computing Techniques and Automation). 1986. 14p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88700501/JAW.

Submitted to the journal Yad. Fiz. .

Momentum spectra of protons in the A(d, p)X reactions on the hydrogen, deuterium and carbon nuclei at 9 GeV/c deuteron momentum have been measured at the JINR synchrophasotron by using a magnetic spectrometer with wire chambers. The measurements have been made at an angle of 0.139 rad and have covered the proton momentum interval from 3.3 to 1.3 GeV/c. It has been found that the high momentum parts of the proton spectra are universal, i.e. their shape does not depend on the target nucleus. The momentum spectrum of protons in the /sup 1/H(d, p)X reaction is reasonably reproduced in the framework of analysis based on the relativistic hard collision model. The momentum distribution of nucleons in a deuteron obtained on the basis of this analysis is discussed. 26 refs.; 3 figs.

10058 **(JINR-R—1-86-809) Longitudinal distribution of ionization losses in electron-photon showers produced by γ quanta with the E/sub γ/ = 200-3500 MeV.** Slovinskij, B.; Chizhevska, D.; Endzheets, G.; Chaj, V.; Vis'nevskij, R. (Joint Inst. for Nuclear Research, Dubna, USSR. Lab. of Computing Techniques and Automation; Institute of Nuclear Research, Warsaw, Poland; Energetics and Atomic Energy Information Centre, Warsaw, Poland; Politechnika Warszawska, Poland; Politechnika Warszawska, Poland. Inst. Fizyki). (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Computing Techniques and Automation; Politechnika Warszawska (Poland). Inst. Fizyki). 1986. 17p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88700908/JAW.

Ionization losses (IL) of shower electrons and positrons in electromagnetic cascades produced by gamma quanta with the E/sub γ/=200-3500 MeV energy in liquid xenon has been measured. The distribution of average IL along a cascade axis is described by the Weibull function. Approximation of the parameters of this function is obtained. Experimental material consists of the pictures of 180 liter xenon bubble chamber irradiated by the π/sup -/-mesons with the 3.5 GeV/c momentum. 16 refs.; 6 figs.; 6 tabs.

10059 **(JINR-R—1-86-810) Cross distribution of ionization losses in electron-photon showers initiated by γ quanta with E/sub γ/ = 200-3500 MeV.** Slovinskij, B.; Chizhevska, D.; Endzheets, G.; Vis'nevskij, R. (Joint Inst. for Nuclear Research, Dubna, USSR. Lab. of Computing Techniques and Automation; Institute of Nuclear Research, Warsaw, Poland; Energetics and Atomic Energy Information Centre, Warsaw, Poland; Politechnika Warszawska, Poland. Inst. Fizyki). (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Computing Techniques and Automation; Politechnika Warszawska (Poland). Inst. Fizyki). 1986. 8p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88700909/JAW.

The measurements of ionization losses (IL) of electron and positron energy in electromagnetic showers initiated by gamma quanta with the E/sub g/amma=200-3500 MeV energy in liquid xenon has been performed. Simple formulae approximating experimental data concerning average IL in direction perpendicular to the shower axis are obtained. As a source of experimental material the pictures of the 180 liter xenon buble chamber exposed in a beam of π/sup -/ mesons with the 3.5 GeV/c momentum are used. 9 refs.; 8 figs.; 1 tab.

10060 **(JINR-R—1-86-811) Fluctuations of ionization losses in electromagnetic showers created by γ-quanta with the E/sub γ/ = 200 - 3500 MeV energy.** Slovinskij, B.; Chizhevska, D.; Endzheets, G.; Vis'nevskij, R. (Joint Inst. for Nuclear Research, Dubna, USSR. Lab. of Computing Techniques and Automation; Institute of Nuclear Research, Warsaw, Poland; Energetics and Atomic Energy Information Centre, Warsaw, Poland; Politechnika Warszawska, Poland. Inst. Fizyki). (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Computing Techniques and Automation; Politechnika Warszawska (Poland). Inst. Fizyki). 1986. 7p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88700910/JAW.

Using pictures of the 180-liter xenon bubble chamber irradiated by the mesons at 3.5 GeV/c ionization energy losses (IL) of electrons and positrons in electromagnetic showers produced by gamma quanta with the E/sub γ/=200-3500 MeV energy has been measured. Estimations of quantities describing fluctuations of shower dimensions such as variation coefficient of a part of IL along ad perpendicular to the shower axis, spread mean square, and variations of average longitudinal and transversal shower dimensions are obtained. 7 refs.; 5 figs.; 1 tab.

10061 (KEK—86-13, pp 110-123) **Charmed particle production by hadron beam at LEBC-EHS, CERN.** Kitamura, Shoichi. (Tokyo Metropolitan Univ., Japan. Faculty of Science). Mar 1987. (In Japanese). NTIS (US Sales Only), PC A09/MF A01. Order Number DE88780031/JAW. (CONF-8701101—).

From Symposium on hadron spectroscopy; Oho, Ibaraki, Japan (8 Jan 1987).

Results on charmed particle hadronic production obtained at the experiment of LEBC-EHS exposed to CERN-SPS beam are presented, and compared with other experimental data. A discussion is made on production mechanism and decay property of charmed particle.

10062 (KEK—86-13, pp 37-41) **Measurement of the anti pp -> π/sup +/π/sup -/ and anti pp -> K/sup +/K/sup -/ cross sections between 360 and 760 MeV/c.** Sugimoto, Y. (Kyoto Univ., Japan. Dept. of Physics). Mar 1987. NTIS (US Sales Only), PC A09/MF A01. Order Number DE88780031/JAW. (CONF-8701101—).

From Symposium on hadron spectroscopy; Oho, Ibaraki, Japan (8 Jan 1987).

An experiment is executed to search for structure in the σsub(anti pp -> π/sup +/π/sup -/) and σsub(anti pp -> k/sup +/k/sup -/). In the experiment, σsub(anti pp -> π/sup +/π/sup -/) and σsub(anti pp -> k/sup +/k/sup -/) are measured at 15 incident beam momenta between 360 and 760 MeV/c with better statistics than any of previous experiments. The measured quantity is the folded differential cross section, dσ/dΩ (θ*) + dσ/dΩ (π-θ*). The trigger condition is the existence of an incident antiproton and two or more outgoing charged particles with no veto-counter hit. The π/sup +/π/sup -/ and K/sup +/K/sup -/ events are selected from huge background by requiring coplanarity and by inspecting the opening angle between the two outgoing particles. A variable R/sub πk/ is defined in order to separate the π/sup +/π/sup -/ and K/sup +/K/sup -/ events. It is shown that K/sup +/K/sup -/ events clustering around R/sub πk/ = 0 are clearly separated from the π/sup +/π/sup -/ events around R/sub πk/ = 1. Various normalization corrections are applied to the data, and additional systematic errors are taken into account. The folded differential cross sections obtained in this experiment are fitted with a Legendre polynomial series Σsub(n=0)sup(n-max) a/sub n/P/sub n/ (cosθ*) (n even), and σsub(anti pp ->π/sup +/π/sup -/) and σ are given by 2πa/sub 0/. A satisfactory fit is obtained with n-max = 4 (for the π/sup +/π/sup -/ channel, the terms up to n-max = 6 are used). No significant structure is observed both in σ and in σ. The 90 % cinfidence-level upper limits for posible resonances determined from the present results are -70 μb for pp -> π/sup +/π/sup -/ and -40 μb for pp -> K/sup +/K/sup -/. (Nogami, K.).

10063 **(KEK—86-13) Topics on hadron spectroscopy.** Bando, M.; Kobayashi, M.; Dyanagi, Y.; Suzuki, S.; Takamatsu, K.; Tsuru, T. (eds.). (National Lab. for High Energy Physics, Oho, Ibaraki (Japan)). Mar 1987. vp. (CONF-8701101—). NTIS (US Sales Only), PC A09/MF A01. Order Number DE88780031/JAW.

From Symposium on hadron spectroscopy; Oho, Ibaraki, Japan (8 Jan 1987).

Individual papers in these proceedings are abstracted separately. (LEW)

10064 **(LAPP-EXP—86-72) B physics at electron-positron colliders.** Coignet, G. (Grenoble-1 Univ., 74 - Annecy (France). Lab. de Physique des Particules). Oct 1986. 11p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88751635/JAW.

The physics of B mesons that has already been achieved and is expected to be achieved in the near future is quickly reviewed. Emphasis is put on the problems that could be left over and the case for an improved b factory machine is advocated.

10065 **(LPC—86-24) Recent results from the UA1 experiment at CERN.** Dobrzynski, L. (College de France, 75 - Paris. Lab. de Physique Corpusculaire). Oct 1986. 51p. (CONF-8608205—). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88750673/JAW.

From SLAC summer institute topical conference; Stanford, CA, USA (6 Aug 1986).

Results based on a sample of events with large missing transverse energy corresponding to 715 nb/sup -1/ of data from the UA1 experiment at the CERN antipp Collider are presented. High transverse momentum tau-leptons from W decays are observed for the first time through their semi-hadronic decay modes. The first direct tests of the e-μ-tau universality of the weak charged couplings at Q/sup 2/=m/sup 2//sub W/ is provided. Measured W and Z/sup 0/ rates and heavy flavour cross sections are used to predict rates of missing transverse energy events from all known Standard Model processes, and thereby to place limits on possible new sources. After taking into account all known sources of missing energy events, we find a mass limit on a fourth generation charged lepton of m/sub L/ > 41 GeV/c/sup 2/ and a limit on the number of additional neutrinos of N/sub ν/ < 7. Lower limits for supersymmetric particles, namely 60 GeV/c/sup 2/ for the gluino and 70 GeV/c/sup 2/ for the squark are also given. Finally, two events are presented in which two energetic hadronic jets and a high energy lepton are balanced by missing energy. These events are discussed and compared to all observed W + 2-jet events.

10066 **(RAL—86-058) Compilation of data on $\gamma \cdot \gamma \rightarrow$ hadrons.** Roberts, R.G.; Whalley, M.R. (Rutherford Appleton Lab., Chilton (UK)). Jun 1986. 36p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88750792/JAW.

Data on $\gamma\gamma \rightarrow$ hadrons extracted from e^+e^- reactions is compiled. The review includes inclusive cross-sections, structure functions, exclusive cross-sections and resonance widths. Data up to 1st July 1986 are included. All the data in this review can be found and retrieved in the Durham-RAL HEP database, together with a wide range of other reaction data. Users throughout Europe can interactively access the database through CMS on the RAL computer.

10067 **(SLAC-PUB—4466) Indications for the decays D/sub s//sup +-/ $\rightarrow$ eta π/sup +-/ and D/sub s//sup +-/ $\rightarrow$ eta' π/sup +-/.** Wormser, G. (Stanford Linear Accelerator Center, Menlo Park, CA (USA)). Nov 1987. Contract AC03-76SF00515. 5p. (CONF-8709147—3). NTIS, PC A02/MF A01. Order Number DE88003605/JAW.

From International symposium on the production and decay of heavy flavors; Stanford, CA, USA (1 Sep 1987).

A search for D/sub s//sup +-/ decays into eta π/sup +-/ and eta' π/sup +-/ has been performed by the MarkII collaboration at the PEP e^+e^- storage ring. Eta particles are reconstructed by their $\gamma\gamma$ decay mode. The eta fragmentation has been measured and found to be in good agreement with the Lund model prediction. Eta' production has been measured for the first time in e^+e^- high energy annihilation. Good indications are found for both decay modes D/sub s//sup +-/ $\rightarrow$ eta π/sup +-/ and D/sub s// sup +-/ $\rightarrow$ eta' π/sup +-/.

10068 **(SLAC-PUB—4467) Observation of D/sub s/$^+$ $\rightarrow$ eta $\pi\mu$, and a new limit on $D^+ \rightarrow \mu^+$ nu/sub μ/ and f/sub D/.** Stockdale, I.E. (Illinois Univ., Urbana (USA)). Nov 1987. Contract AC03-76SF00515;AC02-76ER01195;AC03-81ER40050. 7p. (CONF-8709147—5). NTIS, PC A02. Order Number DE88003278/JAW.

From International symposium on the production and decay of heavy flavors; Stanford, CA, USA (1 Sep 1987).

We report two new results on charmed D^+ and /sub s/$^+$ decays, obtained using the Mark III detector at the e^+e^- storage ring SPEAR. We report the first observation of the decay D/sub s/$^+ \rightarrow$ eta π^+. The product branching fraction is measured to be $\sigma(e^+e^- \rightarrow$ D/sub s/$^+$ D/sub s/$^{*-}$ + c.c.) x B(D/sub s/$^+ \rightarrow$ eta π^+) = (74 +- 19 +- 25) pb. Second, we describe a search for the leptonic decay $D^+ \rightarrow \mu^+$ eta/sub μ/. A 90% confidence level upper limit on B)$D^+ \rightarrow \mu^+$ eta/sub μ/) of 7.2 x 10^{-4} is obtained, corresponding to an upper bound of 290 MeV/c^2 on the pseudoscalar decay constant f/sub D/.

10069 **Progress report on experiments to study weak neutral current elastic scattering of neutrinos and neutrino oscillation.** Nagashima, Y.; Abe, K.; Ahrens, L.; Amako, K.; Aronson, S.; Beier, E.; Connolly, P.; Cutts, D.; Doughty, D.; Dulude, R. (Brookhaven National Lab., Upton, NY). pp 329-344 of Topical symposium on high energy physics. Eguchi, T.; Yamaguchi, Y. Teaneck, NJ; World Scientific Pub. Co. (1983). (CONF-8209304—).

From Topical symposium on high energy physics; Tokyo, Japan (7 Sep 1982).

This paper discusses the experimental studies of elastic scatterings of neutrino on an electron and a photon.

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REFER ALSO TO CITATION(S) 10042, 10063, 10165

10070 **(BONN-HE—87-12) Actual interpretation of recent results on meson photoproduction.** Diekmann, B. (Bonn Univ. (Germany, F.R.). Physikalisches Inst.). Jun 1987. 12p. (CONF-8704177—). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88751004/JAW.

From 2. international conference on hadron spectroscopy; Tsukuba, Japan (16 Apr 1987).

Actual ideas to remove existing discrepancies between photoproduction and e/sup +/e/sup -/-production on searching radially excited rho-mesons will be discussed. An update of a candidates list for corresponding ω and phi excitations is given. Photoproduction properties of two possibly exotic states are presented: A meikton-state decaying into b/sub 1/(1235)π and the well known a/sub 0/(980) meson.

10071 **(CONF-8708102—8) Pion production in the quark compound Bag model of NN scattering.** Lee, T.S.H. (Argonne National Lab., IL (USA)). Aug 1987. Contract W-31109-ENG-38. 10p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88002973/JAW.

From Pion nucleus physics: future directions and new facilities at LAMPF workshop; Los Alamos, NM, USA (17 Aug 1987).

The quark compound Bag model of NN scattering is reviewed and extended to study pion-production from NN collisions. 12 refs., 6 figs., 1 tab.

10072 **(IFVE-OTF—85-186) Q/sup 2/-dependence of the average multiplicity in deep-inelastic processes.** Kiselev, A.V.; Petrov, V.A. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1985. 6p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88700394/JAW.

A detailed Q/sup 2/-dependence (where Q/sup 2/-Jour-momentum transfer squared) of the hadron average multiplicity in μp-collisions is calculated on the basis of the formula obtained by the

authors earlier. The results agree with the latest EMC experimental data. 7 refs.; 2 figs.

10073 **(IFVE-OTF—86-4) Difference in leptoproduction of hidden flavors on nuclei and nucleons.** Batunin, A.V. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1986. 7p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88700396/JAW.

Submitted to the journal Sov. J. Nucl. Phys. .

On the basis of the nucleon colour oscillations in a nucleus an increase (~ 10/sup 2/ per nucleon) of the PSI-meson leptoproduction yield on heavy nuclei (Fe, etc.) is predicted as compared with that on single nucleons. When hidden beauty is leptoproduced, the nuclear enhancement effect may not occur up to ~ 200 GeV. 12 refs.; 5 figs.

10074 **(IFVE-OTF—86-78) COLOR computer code for calculation of group factors of Feynman diagrams in non-Abelian gauge theories.** Kryukov, A.P.; Rodionov, A.Ya. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1986. 12p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88700398/JAW.

Realization of the Color computer code algorithm for calculation of group factors of Feynman diagrams in non-Abelian gauge theories is described. The algorithm can be applied to different symmetry groups, including SU(n) and SO(n) groups. A computer code written in REDUCE computer algebra language is given. The computer code functioning is illustrated by QCD examples. 3 refs.

10075 **(IFVE-OTF—86-80) Chi/sub c/ charmonium - a tool to investigate gluon polarization.** Batunin, A.V.; Slabospitskij, S.R. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1986. 6p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88700399/JAW.

Production of particles with a hidden charm CHI/sub C/ in polarized parton beams (quarks or gluons) is studied. Parton polarization is shown to cause the changes of angular distributions of CHI/sub C/ meson decay products, which allows one to investigate possible gluon polarization in hadrons. 5 refs.; 1 fig.; 2 tabs.

10076 **(IFVE-OTF—86-122) Is naive pomeron compatible with confinement.** Petrov, V.A. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1986. 3p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88700400/JAW.

Submitted to the journal Sov. J. Nucl. Phys. .

The compatibility of the "naive pomeron" (a/sub p/(0)=1) for partonic amplitudes with the absence of physical singularities in colored channels (confinement) is discussed. 5 refs.

10077 **(IFVE-OTF—86-124) On search for s neutrino.** Larin, V.N.; Tikhonin, F.F. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1986. 4p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88700401/JAW.

Submitted to the journal Sov. J. Nucl. Phys. .

A simple analytic expression for the cross section of the E/sup +/e/sup -/ -> γ+ν-tildeν-tilde process, which is needed for one of possible ways to present supersymmetry manifestations, has been obtained. The results of this paper have been compared with those from two previous papers, which are in disagreement between themselves. The calculational procedure has been discussed in brief. 11 refs.

10078 **(IFVE-OTF—86-125) O/sup -/ nonet and U(1) problem solution in nonperturbative QCD.** Nekrasov, M.L.; Rochev, V.E. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1986. 14p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88700402/JAW.

Submitted to the journal Theor. Math. Phys. .

In the model of dynamical chiral symmetry breaking by the QCD infrared singularities the description of the pseudoscalar meson nonet (π, K, eta, eta') as (quasi) Goldstone bosons is performed. The nonet decay constant in the chiral limit is evaluated. The U(1)-problem is solved: the eta'-meson massin the chiral limit and the topological susceptibility are evaluated as well as the physical eta, eta'-meson masses and the pseudoscalar mixing angle are determined over the chiral perturbation theory. 13 refs.; 1 fig.

10079 **(IFVE-OTF—86-172) Pair production of exotic particles at pp(p-barp) colliding beams.** Borisov, G.V.; Pirogov, Yu.F.; Rudakov, K.R. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1986. 24p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88700870/JAW.

Submitted to the journal Zeit. Phys. C -Part Fields.

A complete set of differential cross sections has been obtained in Born approximation for pair production of exotic particles with various spins J=0, 1/2, 1 and quantum numbers (colored and colorless) both in qq-bar and gg-collisions. The connection of the unitarity of vector boson processes with gauge invariance, factorization properties of non-Abelian gauge amplitudes and the presence of kinematic zeros is used. Besides, the problem of admissibility of massless limit for these processes is being discussed. The yield of exotic particle pairs at pp(p-barp) colliding beams in TeV energy range have been calculated and limits for the accessible mass range have been found. 13 refs.; 12 figs.

10080 **(IFVE-OTF—86-187) Three- and four-gluon vertex functions in the QCD infrared region.** Arbuzov, B.A.; Davydychev, A.I. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1986. 16p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88700403/JAW.

The consequences of gauge identities for gluon self-action vertices in the infrared region using the gluon propagator asymptics D(k) ~ M/sup 2//k/sup 4/ are investigated. It is obtained under certain conditions that three- and four-gluon vertex functions are defined by gauge identities up to single parameter, which corresponds to the transverse part of the three-gluon vertex. The connection of the obtained resuls with the effective infrared gluon Lagrangian, introduced earlier is discussed. 14 refs.

10081 **(INFN/AE—86-8) Possible consequences for neutrino oscillations of a tachyonic muon neutrino.** Giannetto, E.; Maccarrone, G.D.; Recami, E.; Mignani, B. (Istituto Nazionale di Fisica Nucleare, Rome (Italy)). 1986. 10p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88700765/JAW.

Some papers appeared recently, which are noticeable since they call attention to interesting experimental results referring to the old-dated question whether neutrinos are Superluminal (or not): but they diregarded most of the previous theoretical literature. We complement them, therefore, from the theoretical point of view; and add some experimental predictions that could be tested, especially in connection with neutrino oscillations. 32 refs.

10082 **(INIS-BR—868) Unified gauge theory for the weak and electromagnetic interactions of the tau heavy lepton.** Vasconcelos Filho, A.V. de. (Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro). 1979. 117p. (In Portuguese). NTIS (US Sales Only), PC A06/MF A01. Order Number DE88700408/JAW.

The Weinberg-Salam model which unifies the weak and electromagnetic interactions under a same gauge formalism and the properties of the new tau+/sup -/ heavy lepton are discussed. Yang-Mills theory, Goldstone bosons, Higgs mechanism, weak and electromagnetic currents and the SU(2)xU(1) group, which generates these currents are presented. The Weinberg-Salam model and their extensions with four (GIM model) and six quarks are described. A tau -lepton study is presented where their known properties are summarized and a way to determine the spin of this lepton is proposed. The calculation of the tau decays are done in detail, because is through these decays that it is possible to reach the true spin of the heavy lepton. (L.C.).

10083 (INIS-mf—11052, pp vp) **Scattering of polarized neutrons off polarized protons at 14.5 MeV.** Formanek, J. (Karlova Univ., Prague, Czechoslovakia. Fakulta Matematicko-Fyzikalni). 1985. NTIS (US Sales Only), PC A19/MF A01. Order Number DE88700667/JAW. (CONF-8509430—).

From International summer school on hyperfine interactions and international study meeting: physics with oriented nuclei; Bechyne, Czechoslovakia (2 Sep 1985).

10084 (INIS-mf—11052, pp vp) **Neutrino mass: present state of the problem.** Abov, Yu.G. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1985. (In Russian). NTIS (US Sales Only), PC A19/MF A01. Order Number DE88700667/JAW. (CONF-8509430—).

From International summer school on hyperfine interactions and international study meeting: physics with oriented nuclei; Bechyne, Czechoslovakia (2 Sep 1985).

The problems are discussed of the neutrino mass. Experimental values measured in recent years are given. A detailed analysis is made of experiments in which the neutrino mass is determined from the shape of the tritium beta spectrum. Attention is mainly focused on experiments which were made by Lyubimov and Tret'yakov at the Institute of Theoretical and Experimental Physics in Moscow. (Z.J.).

10085 (INIS-mf—11054, pp 76) **Electromagnetic mass difference of measons.** Flamm, D.; Schoeberl, F.; Uematsu, H. (Vienna Univ., Austria. Inst. fuer Theoretische Physik). Sep 1987. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88700772/JAW. (CONF-8709196—).

From Annual convention fo the Austrian Physical Society; Vienna, Austria (21 Sep 1987).

10086 (INIS-mf—11054, pp 68) **Separable approximation of the BONN nucleon-antinucleon potential.** Bachmaier, G. (Graz Univ., Austria. Inst. fuer Theoretische Physik). Sep 1987. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88700772/JAW. (CONF-8709196—).

From Annual convention fo the Austrian Physical Society; Vienna, Austria (21 Sep 1987).

10087 (INIS-mf—11054, pp 73) **Three-body forces in the nucleon.** Eder, G.; Faber, M.; Kamesberger, J.; Markum, H. (Technische Univ., Vienna, Austria). Sep 1987. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88700772/JAW. (CONF-8709196—).

From Annual convention fo the Austrian Physical Society; Vienna, Austria (21 Sep 1987).

10088 (INIS-SU—425, pp 24-31) **π/sup +/->e/sup +/ νe/sup +/e/sup -/ decay and axial form factors of π-meson.** Mzhaviya, D.A.; Tkebuchava, F.G.; Mitsel'makher, G.V. (Tbilisskij Gosudarstvennyj Univ., USSR). 1985. (In Russian). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88780037/JAW. (JINR-N—19-86).

In JINR rapid communications. Collection.

The decay π/sup +/ -> e/sup +/e/sup -/ν is considered. The differential and total probabilities of this process are calculated. Opportunities and unambiguous determination of the axial form factor γ are analysed. It is pointed out that already now the experimental data on pion polarizability allow an unambiguous choice between two values of γ.

10089 (INIS-SU—425, pp 32-39) **Description of binary reactions in the relative four-velocity space.** Malakhov, A.I.; Melkumov, G.L. 1985. (In Russian). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88780037/JAW. (JINR-N—19-86).

In JINR rapid communications. Collection.

The results of analysis of binary reactions of the type of charge exchange π/sup -/+p -> π/sup 0/(eta, ω)+n in a wide momentum interval from 3 to 200 GeV/c in the relative four-velocity space using b parameter determined by four-velocities of prticles are given. Like a hadron jet productions, the statistical regularity for binary reactions is realized - the cross sections of those monotonously and rather sharply decrease with b increasing. The B and <b> dependence on incident particle momentum points to the universal properties of b distribution for π/sup 0/, eta, ω. These distributions are independent of energy beginning from p/sub π(sup -)/ =20-50 GeV/c. The parameters B and <b> for π/sup 0/ from binary reactions and for π/sup -/ from the hadron jets are approximately the same.

10090 (INS—633) **Flavor dependence of quasi Nambu-Goldstone fermion masses.** Yasue, Masaki; Terazawa, Hidezumi. (Tokyo Univ., Tanashi (Japan). Inst. for Nuclear Study). Jun 1987. 13p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88751047/JAW.

A possible flavor dependence of masses for light quasi Nambu-Goldstone fermions (QNGF's) is examined in a supersymmetric (SUSY) nonlinear-interaction-model of the Nambu-Jona-Lasinio type with SO(2N,C) -> SO(n,C) x SO(2N-n,C) by <A/sub i//sup (1)/A/sub i//sup (2)/> ~ Λ/sup 2/, in which subquarks (A/sub i/,PSI/sub i/)/sup (a)/ (a = 1, 2; i = 1 ~ 2N) belong to 2N. SUSY is broken by scalar mass terms, anti μ/sub i//sup 2/ chemical bondA/sub i//sup (a)/chemical bond/sup 2/ and μ/sub i//sup 2/A/sub i//sup (1)/A/sub i//sup (2)/ (anti μ/sub i/,μ/sub i/ << Λ). Masses of QNGF's, M/sub QNGF/, are controlled by M/sub iSS//sup 2/ = anti μ/sub i//sup 2/ + cμ/sub i//sup 2/: M/sub QNGF/ = m/sub F/ + fM/sub iSS//sup 2/ + gM/sub jSS//sup 2/ with m/sub F/ = O(M/sub SS//sup 2//Λ), f,g = O(A/sup -1/) and c= O(1) for i in SO(n) and j in SO(2N-n). Large mass splitting between QNGF's and (pseudo) Nambu-Goldstone bosons ((P)NGB's): M/sub QNGF//M/sub (P)NGB/ = O(M/sub SS//Λ) << 1 is shown to arise.

10091 (INS—634) **Search for dibaryon resonances in photo-deuteron reactions.** Maruyama, Koichi. (Tokyo Univ., Tanashi (Japan). Inst. for Nuclear Study). Jun 1987. 15p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88751048/JAW.

The present status of non-strange dibaryon resonances including two new data contributed to this conference is briefly surveyed. A new γd experiment using a spectrometer, TAGX, with an acceptance of π sr at the 1.3 GeV Tokyo Electron Synchrotron (ES) is described. Discussions on search for some structures in E/sub γ/ dependence of γd -> π/sup -/pp reaction and γd -> π/sup -/X missing mass spectra are presented on the basis of a preliminary analysis of the experiment.

10092 (INS—637) **Composite quarks and leptons generated by supersymmetric quantum chromodynamics with N/sub 'color'/ < N/sub 'flavor'/.** Yasue, Masaki. (Tokyo Univ., Tanashi (Japan). Inst. for Nuclear Study). Jul 1987. 45p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88751060/JAW.

Quarks and leptons together with other exotic fermions are regarded as quasi Nambu-Goldstone fermions and chiral fermions generated by supersymmetric quantum chromodynamics (SQCD) with N/sub "color"/ (=) < N/sub "flavor"/ (= M). A mass protection symmetry, H, contains a chiral SU(M-N) [or SU(M-N + 1)] symmetry as well as a chiral U(1) symmetry supported "algebraically" by complementarity and "dynamically" by effective superpotential. The successive SUSY-breaking is constrained by the remnant of the QCD dynamics, i.e. the complete breakdown of chiral symmetries in H. The large mass splitting between J = 1/2 and J = 0 is shown to arise and masses for light composite fermions are specified by the SUSY-breaking scale M/sub SS/ and the confinement scale Λ/sub sc/: M/sub SS/(M/sub SS//Λ/sub sc/)/sup (M-N)/2κ/ for M/sub SS/ << Λ/sub sc/, where 2κ $\leqq$ M-N is imposed by the consistency with the anomaly-matching.

10093 (INS—638) **NΔ-NN interaction in the pionic disintegration of the deuteron.** Tanabe, H.; Ohta, K. (Tokyo Univ., Tanashi (Japan). Inst. for Nuclear Study). Jul 1987. 40p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88751061/JAW.

The cross sections for the pionic disintegration of the deuteron in the Δ-resonance region are calculated based on a unitary three-body model. The NΔ-NN transition potential is constructed from the πN P/sub 11/ and P/sub 33/ scattering amplitudes extrapolated to the off-shell region, and from the πNN three-body propagator. The idea of the two-potential model for the P/sub 11/ wave is extended to the P/sub 33/ wave. The parameters of the model are deduced from the fits to the πN scattering phase shifts. It is found that the off-shell P/sub 11/ and P/sub 33/ scattering amplitudes behave quite similarly to the monopole form factor with a cut-off momentum Λ = 600 MeV/c as obtained earlier in the perturbation model by Gibbs, Gibson, and Stephenson. It is also found that the backward-propagating-pion component of the πNN propagator, which is often ignored in three-body calculations, is crucial to reproduce the magnitude of the total cross section. The three-body calculation is compared to the perturbation calculations. The second-order perturbation gives the results which closely approximate the full-order three-body calculation.

10094 **(IPNO-TH—86-55) Similarities and differences between antipp and pp scattering at TeV energies and beyond.** Gauron, P.; Nicolescu, B.; Leader, E. (Paris-11 Univ., 91 - Orsay, France. Inst. de Physique Nucleaire; London Univ., UK). (Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire). Dec 1986. 59p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE88751746/JAW.

The significant difference between the pp and antipp elastic dσ/dt discovered at the CERN ISR, and the behaviour of the antipp dσ/dt at the CERN collider, which have profound implications for the asymptotic behaviour of hadron scattering amplitudes, are explained in terms of a model theory based upon general S-matrix principles and a dynamical assumption of "maximal strength" for the strong interactions. Our model theory provides an excellent description of the pp and antipp data in the huge range 10 ≦ √s ≦ 630 GeV for /t/ ≦2.5 (GeV)/sup 2/. Several striking consequences of the theory will be testable at Tevatron energies and beyond.

10095 **(IPNO-TH—86-85) Maximum mass for the chiral σ-model fermion and implications for decoupling and "classical" heavy fermion decay.** Soni, V. (Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire). Dec 1986. 34p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88751749/JAW.

We find a limiting mass for the fermion in the σ-model, at the semi-classical model. This mass, M/sub max/, depends exclusively on the vacuum expectation value (VEV), <σ>, of the Higgs field. Below a critical value of the Yukawa coupling g/sub c/, the one fermion ground state is realized with the usual space uniform VEV of the Higgs as a Yukawa fermion of mass, g <σ> <M/sub /m/sub ax/. For g>g/sub c/ the one fermion ground state has a space varying and "topological" VEV with an energy E/sup TOT//sub MIN/ ≦M/sub MAX/. For g much greater than g/sub c/, the "mass" of the topological fermion (E/sup TOT//sub MIN/) decreases with increasing, g, going below zero at some g = g/sub o/ (g/sub o/>>g/sub c/). At this point the theory is unstable both in the 1 fermion (antifermion) and vacuum sectors. These features generalize to large N/sub c/. It is shown that the existence of the maximum mass of the fermion and the above behaviour with respect to the Yukawa coupling severly limit the conclusions on the decoupling of heavy fermions and the so called unsuppressed or "classical" decay of heavy fermions and technibaryons.

10096 **(ITEP—51-1985) Second moments of quark and gluon distribution functions in nucleon.** Belyaev, V.M.; Blok, B.Yu. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1985. 24p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88700453/JAW.

The second moments of quark and gluon distribution functions in proton are calculated on the basis of the QCD sum rule approach. The results obtained are in a good agreement with the experimental data. 15 refs.; 7 figs.

10097 **(ITEP—65-1985) Spin-orbit couplings in the string model.** Kobzarev, I.; Martem'yanov, B.; Shchepkin, M. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1985. 19p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88700454/JAW.

The spectrum of mesons with high spins is considered in the rotating string model. It is shown that Thomas precession of quarks spins gives rise to spin-orbit coupling. Predictions of the model agree with the experimental data on mass spectrum of mesons with even parity and even spins. 19 refs.; 3 figs.

10098 **(ITEP—96-1986) Bremsstrahlung corrections in the π/sup 0/ -> e/sup +/e/sup -/ decay.** Ratnikov, F.D. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1986. 16p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88700455/JAW.

Bremsstrahlung in the π/sup 0/ -> e/sup +/e/sup -/ decay is considered together with the Dalitz decay π/sup 0/ -> e/sup +/e/sup -/γ. The interference of the Dalitz decay with the zere order in the photon energy contribution to the bremsstrahlung in the π/sup 0/ -> e/sup +/e/sup -/ decay is calculated. It is found that such a bremsstrahlung contribution is of the same order of magnitude as the basic decay into lepton pair. 17 refs.

10099 **(ITEP—139-1986) Universality of the Froissart limit of σ/sup tot/(s)/(ln/sup s//m/sub N//sup 2/)/sup 2/ for colliding hadrons or nuclei.** Ter-Martirosyan, K.A. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1986. 28p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88700456/JAW.

Making use of the supercritical pomeron model it is shown that at s -> ∞ the ratio σ/sup tot/(s)/(ln s/m/sub nN//sup 2/)/sup 2/ approaches the Froissart limit 2πa/sup 2/=Const which is independent of the kind of colliding particles, and increases slowly from the value of ~ 0.25 mb to 0.3-0.6 mb at superhigh energies √s >or approx. 10/sup 10/ GeV. The multipomeron-exchange graphs have been estimated basing on the two-channel model. In far asymptotics the threshold singularity at t=4m/sub π//sup 2/ in (α, dt) and the interaction between Pomerons are essential leading to the slow increase of the quantity σ/sup tot//(ln s/m/sub N//sup 2/)/sup 2/ ~ 2na/sup 2/ up to 0.5 mb. At superhigh energies, when the rising radius of hadron R/sub int/ ~ a ln s/m/sub N//sup 2/ exceeds the nuclear radius R/sub A/=rho/sub 0/A/sup 1/3/, the cross-section σ/sub NA//sup tot//(ln s/m/sub N//sup 2/)/sup 2/ and even σ/sub A(sub 1)A(sub 2)//sup tot//(ln s/m/sub N//sup 2/)/sup 2/ are shown to have the same limit 2πa/sup 2/, a ~ 0.4-0.5 f. 19 refs.

10100 **(ITEP—156-1986) On inclusive hadronic widths of beautiful particles.** Khoze, V.A.; Shifman, M.A.; Ural'tsev, N.G.; Voloshin, M.B. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1986. 16p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88700457/JAW.

Preasymptotic (in the heavy quark mass) corrections in the non-leptonic decay rates of beautiful mesons and baryons are considered. The effects of real and virtual gluon emission are taken into account. Main emphasis is put on the difference of the lifetimes of B/sub s//sup 0/ mesons with different CP parity. This difference is found to be the largest in the b-family. Possibilities for experimental study of this phenomenon are briefly discussed. 16 refs.

10101 **(ITEP—160-1986) Monte Carlo study of the multiquark systems.** Kerbikov, B.O.; Polikarpov, M.I.; Zamolodchikov, A.B.; Shevchenko, L.V. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1986. 27p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88700459/JAW.

Random walks have been used to calculate the energies of the ground states in systems of N=3, 6, 9, 12 quarks. Multiquark states with N>3 are unstable with respect to the spontaneous dissociation into color singlet hadrons. The modified Green's function Monte Carlo algorithm which proved to be more simple and much accurate than the conventional few body methods have been employed. In contrast to other techniques, the same equations are used for any number of particles, while the computer time increases only linearly V, S the number of particles. 26 refs.

10102 **(JINR—E-2-86-581) High-quality pion form factor data from e/sup +/e/sup -/ versus that from inverse electroproduction: a compatibility test.** Martinovic, L. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1986. 4p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88700479/JAW.

A simple compatibility check between pion form factor data obtained in inverse electroproduction and electron-positron annihilation is made by using the precise experimental information on the latter, analytically continued to the elastic threshold. Four points from nine inverse electroproduction data are shown to be reliable. 10 refs.; 1 tab.

10103 **(JINR—E-2-86-709) Non-relativistic model of two-particle decay: Galilean invariance revisited.** Dittrich, J.; Exner, P. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1986. 5p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88700481/JAW.

A non-relativistic model of two-particle decay is investigated. The problem of the Galilean invariance for the model is discussed in detail. 3 refs.

10104 **(JINR—E-2-86-789) Fast charmed quark and leading D/sup -/ mesons in π/sup -/p collisions.** Bednyakov, V.A. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems). 1986. 6p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88700485/JAW.

Submitted to the journal Yad. Fiz. .

It is shown on the basis of the quark-quark recombination model that only the D meson, whose light quark is the pion valence quark and whose charmed quark is produced in annihilation of valence quarks and has a large momentum, is a leading meson in reactions like π/sup -/p -> DX. 10 refs.

10105 **(JINR—E-2-86-847) Effects of QCD vacuum and stability of H dihyperon.** Dorokhov, A.E.; Kochelev, N.I. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1986. 12p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88700487/JAW.

Submitted to the journal Phys. Lett. B.

Within the composite quark model taking into account the interaction of quarks in the bag with vacuum fields of QCD the masses of H(I=0, S=-2, J=0, 1/sup C/) and H*(I=O, S=-2, J=1, 1/sup C/) dihyperons are estimated: M/sub H/=2.09 GeV, M/sub H/*=2.34 GeV. It is shown that the leading effect giving a stable with respect to strong decays H dihyperon is the instanton interaction forming diquarks: q/sup 2/(J=0, C=3), q/sup 2/(J=1, C=6). With the approach developed the contribution of QCD hyperfine interaction is suppressed, and instanton induced three-particl forces in multiquark hadrons [q/sup 3/(J=1/2, C=8) - channel] are negligible. 30 refs.

10106 **(JINR-R—1-87-3) Analysis of μ/sup +/μ/sup -/ pair production in experiments with neutral kaons.** Sil'vestrov, L.V. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy). 1987. 10p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88700911/JAW.

The indication on the anomalous production of μ/sup +/μ/sup -/ pairs beyond the target which could not be explained by the known background processes is obtained as a result of the analysis of the data registered on the BIS spectrometer in the experiment with neutral kaons. The invariant masses of these pairs are limited by the M($\mu\mu$) <or approx. 0.38 GeV/c/sup 2/. 15 refs.; 5 figs.; 1 tab.

10107 **(JINR-R—2-86-836) Simulation of proton collisions at UNK energies.** Amelin, N.S. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Computing Techniques and Automation). 1986. 11p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88700916/JAW.

The COLLI-program complex for computer simulation of soft hadronic, hadron-nucleus and nucleus-nucleus collisions is applied for calculation of different characteristics of products from the proton interaction at UNK energies. Instead of the physical model of the proton interaction the quark-gluon string model has been used. Due to the proton collision the strings with quarks at their ends are first produced, then they decay into hadron chains. The exclusive events - results of the proton collision are generated on th basis of the Monte Carlo method. 17 refs.; 8 figs.

10108 **(JINR-R—2-86-837) COLLI-Monte-Carlo generator of soft hadronic, hadron-nucleus and nucleus collisions at high energies.** Amelin, N.S. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Computing Techniques and Automation). 1986. 10p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88700917/JAW.

The COLLI-program complex for computer simulation of the soft hadronic, hadron-nucleus and nucleus-nucleus collisions at high energies is briefly described. Instead of the physical model of the hadron inelastic interaction the quark-gluon string model has been chosen. Different models of the cascade type may be used for consideration of the hadron-nucleus and nucleus-nucleus interaction. The Monte Carlo method is applied to generation of the event as collision result. The programs have been written in FORTRAN standard. The PATCHY system package is used for storage, updating and employment. 19 refs.

10109 (KEK—86-13, pp 12-17) **Analysis of π/sup +/π/sup -/eta channel in πI experiment phase III.** Iwata, T. (Nagoya Univ., Japan). Mar 1987. NTIS (US Sales Only), PC A09/MF A01. Order Number DE88780031/JAW. (CONF-8701101—).

From Symposium on hadron spectroscopy; Oho, Ibaraki, Japan (8 Jan 1987).

High-statisic data on the reaction:π-p->π+π-π/sup 0/n, and π-p->π+π-etan, at 9 GeV/c were obtained in πI. Experiment phase III (E135). The event reconstruction was completed. A preliminery partial wave analysis is performed for the π+π-eta system. The result shows good agreement with πI. Experiment phase I(E64), II(E121).

10110 (KEK—86-13, pp 102-108) **Quark-diquark fragmentation mechanism for meson and baryon productions in proton-proton collisions at 360 GeV/c.** Tsurugai, T. (Tokyo Metropolitan Univ., Japan. Dept. of Physics). Mar 1987. NTIS (US Sales Only), PC A09/MF A01. Order Number DE88780031/JAW. (CONF-8701101—).

From Symposium on hadron spectroscopy; Oho, Ibaraki, Japan (8 Jan 1987).

Feynman x distributions and transverse momentum p/sub T/ distributions for the inclusive reactions pp -> h/sup +-/, π/sup 0/, K-s/sup 0/ Λ/sup 0/, anti Λ/sup 0/, K*/sup +-/, Σ*/sup +-/ + anything at 360 GeV/c are analyzed in terms of the quark-diquark fragmentation models. Comparison of the model predictions with inclusive data reveals that the model with diquarks can quantitatively describe all data. In particular for the baryon production such as pp -> Λ/sup 0/ + anything, the model without diquarks shows serious discrepancies with the data. Using the quark-diquark fragmentation model, we have found that the primordial transverse momentum <k/sub T/> $\simeq$ 0.6 GeV/c can well reproduce p/sub T//sup 2/ distributions and the Feynman x-p/sub T/ correlations.

10111 (KEK—86-13, pp 1-11) **Study of the negative G parity mesons in π/sup -/p charge exchange reaction.** Ohmi, Kazuhito. (Tsukuba Univ., Sakura, Ibaraki, Japan). Mar 1987. NTIS (US Sales Only), PC A09/MF A01. Order Number DE88780031/JAW. (CONF-8701101—).

From Symposium on hadron spectroscopy; Oho, Ibaraki, Japan (8 Jan 1987).

The π/sup -/p forward charge exchange reaction at 8.06 GeV, π/sup -/p -> π/sup +/π/sup -/π/sup 0/n -> rr, has been studied at KEK 12 GeV proton synchrotron with the charged and gamma ray spectrometer system in high statistics. The $\pi\pi\pi$ mass spectrum between 0.9 to 1.8 GeV contains about 160 k events. The intensity and phase relative to 21 + pSO/sup +/ wave of 12 + pDl/sup +/ wave has a large peak around 1.3 GeV, which is dominated by the A/sub 2/ production. In the intensity and phase of the 11 + pSl/sup +/ wave are observed a large broad peak and phase motion around 1.1 GeV. The wave has a quantum number I/sup G/J/sup PC/ = 1/sup -/1/sup ++/, and the structure is due to A, production. Then, in the intensity and phase of 01 + pSO/sup +/ wave, there are a large broad peak and phase motion around 1.1 GeV. The wave has a quantum number I/sup G/J/sup PC/ = 0/sup -/1/sup +-/, and the structure is from H production. (Mori, K.).

10112 (KEK—86-13, pp 27-36) **Search for baryonia and meson spectroscopy in anti pp annihilation at rest.** Kobayashi, Masaaki. (National Lab. for High Energy Physics, Oho, Ibaraki, Japan). Mar 1987. NTIS (US Sales Only), PC A09/MF A01. Order Number DE88780031/JAW. (CONF-8701101—).

From Symposium on hadron spectroscopy; Oho, Ibaraki, Japan (8 Jan 1987).

The present status of analysis for the experiment E68(anti PPC) is briefly described, then, the results obtained and also part of the preliminary results are summarized, and finally, a comment is given on the direction of research to be pursued with low energy antiproton beams. Experiments are carried out using a 580 MeV/c antiproton beam at the KEK 12 GeV proton synchrotron. The main physics aim is the search for baryonia by detecting monochromatic γ rays or π/sup 0/ mesons in anti pp or anti pd annihilation. Besides the reactions, anti pp -> mesons data give useful information on quark dynamics in nucleons and on the annihilation potential in anti NN scattering. Experimental data are analyzed for the following: (i) anti pp -> γx, (ii) anti pp -> π/sup 0/x, (iii) anti pp -> π/sup 0/ M, (iv) anti pp -> etaX, eta'X, etaM for hydrogen target, (v) anti pd -> γX, π/sup 0/ X and (vi) anti pd -> nX for deutron target. (Mori, K.).

10113 (KEK—86-13, pp 62-80) **Hadron spectroscopy and quark model.** Ono, Seiji. (Tokyo Univ., Japan. Dept. of Physics). Mar 1987. NTIS (US Sales Only), PC A09/MF A01. Order Number DE88780031/JAW. (CONF-8701101—).

From Symposium on hadron spectroscopy; Oho, Ibaraki, Japan (8 Jan 1987).

The present report reviews the hadron spectroscopy and quark models. Recently narrow states U/sup -/, U/sup 0/ and U/sup +/ were found at the CERN SPS hyperon beam. These were seen in the (Λp-barπ/sup +/π/sup +/), (Λp-barπ/sup +/π/sup +/π/sup -/) and (Λp-barπ/sup +/π/sup -/) effective mass distributions. The IHEP, Serpukhov group, also found not only U/sup 0/ but also an evidence for another isospin partner U/sup --/. The U has the quantum number of sqq-bar/sup 2/, where q = u or d, but such state is usually believed to be broad. The author has previously shown that some of diquonia (Q/sup 2/Q-bar/sup 2/) will be indeed narrow even for mass = 3.1 GeV, and thus concluded that U meson is a candidate for such diquonium. In this paper, discussion is made of the properties of narrow U(3.1) based on the M-diquanium (color 6 x 6-bar) interpretation, centering on the classification of Q/sup 2/Q-bar/sup 2/ resonances, Q/sup 2/Q-bar/sup 2/ and QQ-bar states in a Bethe-Salpeter model, decay of the diquonium (rearrangement decay and baryon-antibaryon decay), electromagnetic mass splittings (U/sup +/ - U/sup 0/, U/sup 0/ - U/sup -/, and U/sup -/ - U/sup --/), and other narrow diquonia to be found. This report also discusses the relation between the mass of γ(1/sup 1/P/sub 1/) and the QCD scale parameter Λ/sub MS/, El transition of bb states, and new values for Γ/sub ee/(γ) with corrected radiative corrections. (Nogami, K.).

10114 (OUP—87-33) **On the double penguin-like contributions to the B/sup o/-anti B/sup o/ mixing.** Eeg, J.O.; Picek, I. (Oslo Univ. Norway. Fysisk Inst.; Institut Rudjer Boskovic, Zagreb Yugoslavia). (Oslo Univ. (Norway). Fysisk Inst.). Oct 1987. 14p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88751474/JAW.

We investigate double penguin-like diagrams for the B/sup o/-anti B/sup o/ mixing, a missing piece in the literature. We find that the short-distance part of these diagrams contributes <or ~5% and thus is unimportant in reconciling the value of poorly determined parameters of the standard model and the most recent experimental information. We also point out the long-distance hadronic complications which leave the B/sup o/-anti B/sup o/ mixing issue to some extent open. 23 refs.

10115 (RAL—86-013) **Baryon propagator at strong coupling.** Hochberg, D.; Hoek, J. (Rutherford Appleton Lab., Chilton (UK)). Feb 1986. 25p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88750713/JAW.

An attempt is made to improve the results of evaluating a random walk representation for the baryon propagator in an effective action formalism by incorporating partly the effects of a propagating massless pion. This is achieved by calculating part of the random walk exactly and making a cluster expansion for the remainder. The result is that the baryon mass is brought down, but not enough to produce the experimental Δ to rho mass ratio.

10116 (RAL—86-022) **Note on toroidal compactification of heterotic string theory.** Narain, K.S.; Sarmadi, M.H.; Witten, E. (Rutherford Appleton Lab., Chilton (UK)). Jun 1986. 14p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88750787/JAW.

The connection of recently constructed lower dimensional heterotic strings with conventional toroidal compactification is clarified.

10117 (RAL—86-040) **Phenomenology at the CERN pp-bar collider.** Phillips, R.J.N. (Rutherford Appleton Lab., Chilton (UK)). May 1986. 53p. (CONF-8601131—). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88750758/JAW.

From Tata Institute of Fundamental Research winter school in theoretical particle physics; Panchgani, IN, USA (25 Jan 1986).

The paper concerns some comparisons of theory with high-psub(T) data from the CERN pp-bar collider, beginning with some background about the machine and detectors. Later sections describe weak boson searches, high psub(T) jets, heavy quark phenomena and possible E_6 exotica from superstrings.

10118 (RAL—86-051) **On loop amplitudes in the fermionic string.** Namazie, M.A.; Narain, K.S.; Sarmadi, M.H. (Rutherford Appleton Lab., Chilton (UK)). May 1986. 12p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88750783/JAW.

One loop fermionic string amplitudes with up to four massless (bosonic) external legs are calculated in Polvakov's approach and shown to agree with the ones in operator formalism. Some of the ingredients necessary to prove the vanishing of the multiloop amplitudes with up to three external legs are also discussed.

10119 (RAL—87-046) **New experimental evidence for four quark exotics the Serpukhov phiπ resonance and the GAMS etaπ enhancement.** Close, F.E.; Lipkin, H.J. (Rutherford Appleton Lab., Chilton, UK; Weizmann Inst. of Science, Rehovoth, Israel. Dept. of Nuclear Physics). (Rutherford Appleton Lab., Chilton (UK)). Aug 1987. 12p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88751642/JAW.

The C particle is interpreted as a four-quark orbitally excited 'crypto-exotic' state. Further experimental tests of this configuration are suggested as well as possible searches for other states with exotic quantum numbers in the same SU(3) multiplet. Selection rules for hybrid and four-quark decays are discussed and used to propose tests to distinguish between qqq-barq-bar and hybrid qq-

barG interpretations of the GAMS exotic Jsup(PC) = 1/sup -+/ etaπ signal.

10120 **(RRK—87-9) Long distance physics approach to the Dπ and D*π decays of B-mesons.** Terasaki, K.; Oneda, S. (Hiroshima Univ., Takehara (Japan). Research Inst. for Theoretical Physics). Jun 1987. 36p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88751052/JAW.

We have recently developed a non-perturbative algebraic approach to nonleptonic weak interactions which deals with long distance physics in earnest but also maintains a close contact with quark-line diagrams. It has been applied successfully to the derivation of chemical bondΔ I vectorchemical bond = 1/2 rule in K -> 2π decays and also of reasonable estimates of the rates of D/sup 0/ -> πK-bar and phiK-bar/sup 0/ decays. In this paper, we extend the application to the recently observed B -> Dπ and D*π decays. The heavy flavor counterparts of the constraints on the two-particle asymptotic ground-state-meson matrix elements of the strangeness-changing and charm-conserving weak Hamiltonian, which were obtained previously and led to the chemical bondΔ I vectorchemical bond = 1/2 rule in the K -> 2π decays, are derived. They are then shown to yield the branching ratios and the rates of the B -> Dπ and D*π decays reasonably compatible with the recent preliminary observations.

10121 **(SLAC-PUB—4426) Bottom and top physics.** Foley, K.J.; Fridman, A.; Gilman, F.J.; Herten, G.; Hinchliffe, I.; Jawahery, A.; Sanda, A.; Schmidt, M.P.; Schubert, K.R. (Brookhaven National Lab., Upton, NY (USA); Institut National de Physique Nucleaire et de Physique des Particules, 75 - Paris (France); Stanford Linear Accelerator Center, Menlo Park, CA (USA); Massachusetts Inst. of Tech., Cambridge (USA); Lawrence Berkeley Lab., CA (USA); Syracuse Univ., NY (USA). Dept. of Physics). Sep 1987. Contract AC03-76SF00515;AC02-76CH00016;AC02-76ER03069;AC03-76SF00098;AC02-87ER40325;AC02-76ER03075. 15p. (CONF-870739—6). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88003262/JAW.

From Workshop on experiments, detectors, and experimental areas for the supercollider; Berkeley, CA, USA (7 Jul 1987).

The production of bottom quarks at the SSC and the formalism and phenomenology of observing CP violation in B meson decays is discussed. The production of a heavy t quark which decays into a real W boson, and what we might learn from its decays is examined.

10122 **(SLAC-PUB—4439) On weak decays of heavy flavors, mixing and CP violation.** Bigi, I.I. (Stanford Linear Accelerator Center, Menlo Park, CA (USA)). Oct 1987. Contract AC03-76SF00515. 35p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88003610/JAW.

Detailed studies of weak decays serve not only to confirm the Standard Model, but possess also a high sensitivity to New Physics: tau and top decays are discussed in this vein, with some short remarks on beauty and charm. The sensitivity to New Physics is even higher in delicate phenomena like mixing and CP violation: a fairly detailed discussion on K^0 - anti K^0, D^0 - anti D^0, and B^0 - anti B^0 mixing and on CP violation in K^0 and B decays is presented. 48 refs., 11 figs.

10123 **(SLAC-PUB—4455) On charm and beauty decays: A theorist's perspective.** Bigi, I.I. (Stanford Linear Accelerator Center, Menlo Park, CA (USA)). Oct 1987. Contract AC03-76SF00515. 18p. (CONF-8709147—4). NTIS, PC A03/MF A01; GPO Dep. Order Number DE88003606/JAW.

From International symposium on the production and decay of heavy flavors; Stanford, CA, USA (1 Sep 1987).

The present understanding of charm and bottom decays is reviewed. Special emphasis is placed on discussing the theoretical uncertainties in view of the particularly rich harvest of new data from the last year. A semi-quantitative description of D decays has emerged enabling us to address rather detailed and relatively subtle questions there, like on once and twice Cabibbo suppressed decays. Beauty physics having left its infancy is now in its adolescence; its future development towards maturity is analyzed.

10124 **On the contribution of electromagnetic penguins to ϵ'.** Sharpe, S.R. (Stanford Linear Accelerator Center, CA, USA). *Physics Letters [Section] B;* **194**: No. 4, 551-556(20 Aug 1987). Contract AC03-76SF00515.

I discuss the importance of the electromagnetic penguin (EMP) contribution to ϵ'. I confirm the corrections to earlier calculations found by Buras and Gerard (BG). Incorporating these corrections, I calculate the Wilson coefficients of the EMP operators using the full anomalous dimension matrices, and also using the large-N (number of colors) approach of BG. I disagree with BG on the coefficient of the EMP operator dominant at large N: my result is of opposite sign and smaller in magnitude. This means that for large N the EMP contribution increases ϵ', but by less than 1%. I also find that this Wilson coefficient is poorly estimated in the large-N approach. I agree with the BG result for the coefficient of the EMP operator subdominant at large N. This coefficient is large, and is well estimated using the large-N anomalous dimension matrices. I emphasize that the crucial factor determining the EMP contribution to ϵ' is the size of the hadronic matrix elements of the subdominant EMP operator. Though suppressed at large N, it increases ϵ' by 5-20% if one assumes vacuum insertion approximation, and by up to 100% if one uses the results from a recent lattice calculation.

6453 Particle Invariance Principles And Symmetries

10125 **(ITEP—25(1987)) SUSY anomaly in quantum-mechanical systems.** Smilga, A.V. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1987. 8p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88700890/JAW.

Explicit examples of supersymmetric systems involving finite numbers of degrees of freedom where quantum supersymmetry algebra cannot be preserved on the classical level, are constructed. Resolving the ordering ambiguities in different ways leads either to a modified algebra or to a reduced algebra, or totally destroys supersymmetry. 7 refs.

10126 **(JINR—E-2-86-553) Superspaces for N=3 supersymmetry.** Gal'perin, A.S.; Ivanov, E.A.; Ogievetskij, V.I. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1986. 19p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88700478/JAW.

Submitted to the journal Yad. Fiz. .

N=3 superconformal group (SU(2,2/3) is realized in the real analytic subspace of harmonic N=3 superspace. Bererzinian of its transformations is shown to be unity. Conformal invariance of the N=3 Yang-Mills superfield action becomes evident within such a framework. Obtained results are preliminary stage in construction of N=3 supergravity. A complex analytic superspaces are also indicated, having a smaller number of spinor coordinates. A realization of SU(2,2/3) in this superspaces is found. 17 refs.

10127 **(LAPP-TH—180) Cherm-Simons forms and four-dimenional N=1 superspace geometry.** Girardi, G.; Grimm, R. (Grenoble-1 Univ., 74 - Annecy (France). Lab. de Physique des Particules). Dec 1986. 29p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88751755/JAW.

The complete superspace geometry for Yang-Mills, chiral U(1) and Lorentz Chern-Simons forms is constructed. The analysis is completely off-shell and covers the cases of minimal, new minimal and 16-16 supergravity. Supersymmetry is guaranteed by construction. Invariant superfield actions are proposed.

10128 **(RAL—86-021) Heterotic string and supersymmetric counterparts of the Lorentz Chern-Simons terms.** Daniel, M.; Mavromatos, N.E. (Rutherford Appleton Lab., Chilton (UK)). Feb 1986. 8p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88750714/JAW.

The heterotic string 3-point amplitude, which involves two fermionic and one bosonic states determines some of the terms that must be added to the action of the N=1 supergravity coupled to N=1 supersymmetric Yang-Mills in ten dimensions to preserve su-

persymmetry, if the Lorentz Chern-Simons term is included in the definition of the field strength Hsub(μ ν rho) for the cancellation of anomalies. The present calculation reveals an interesting structure, which suggests that the relevant H-Bianchi for the analysis of possible heterotic string compactifications involves a spin connection possibly with torsion.

10129 **(RRK—87-13) On a phase with spontaneously broken scale invariance in three dimensional O(N) models.** Matsubara, Yoshimi; Suzuki, Tsuneo; Yamamoto, Hisashi; Yotsuyanagi, Ichiro. (Hiroshima Univ., Takehara (Japan). Research Inst. for Theoretical Physics). Jun 1987. 14p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88751053/JAW.

A phase with spontaneously broken scale invariance is studied in three dimensional O(N) models. It is shown in every case including a supersymmetric version that such a phase can exist only in the infinite N limit.

6454 Field Theory

REFER ALSO TO CITATION(S) 10019, 10032, 10115, 10127

10130 **(CBPF-MO—001/87) Chiral symmetry in the path-integral approach.** Schaposnik, F.A. (La Plata Univ. Nacional, Argentina. Dept. de Fisica). (Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro). 1987. 74p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE88700833/JAW.

The derivation of anomalous Ward-Takahashi identities related to chiral symmetries in the path-integral framework is presented. Some two-dimensional models in both abelian and non-abelian cases are discussed. The quantization of such theories using Weyl fermions is also presented. (L.C.).

10131 **(CBPF-NF—004/87) Ambiguities in Thirring model under chiral rotations.** Carneiro, C.E.I.; Mignaco, J.A.; Thomaz, M.T. (Centro Tecnico Aeroespacial, Sao Jose dos Campos, Brazil. Inst. de Estudos Avancados; Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro; Universidade Federal Fluminense, Niteroi, Brazil. Inst. de Fisica). (Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro). 1987. 14p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88700836/JAW.

It is studied how different parametrizations of the Thirring model behave under finite chiral rotations with the zeta -function regularization for the fermion determinant. It is shown that in some cases the contribution from the chiral Jacobian may change the sign of the factor which multiplies the quadratic term in the auxiliary field leading to an exponentially divergent theory. It is also proposed how this problem could be remedied by exploiting the invariance of the theory under finite renormalizations.

10132 **(CBPF-NF—005/87) Analiticity in fourth order wave equations.** Bollini, C.G.; Giambiagi, J.J. (La Plata Univ. Nacional, Argentina. Dept. de Fisica; Centro Latino Americano de Fisica, Rio de Janeiro, Brazil). (Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro). 1987. 25p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88700837/JAW.

Through a familiar example (δ-function potential in one dimension) the analytic properties of Jost functions associated with fourth order equations are presented. It is shown how to construct the Jost functions and the two discontinuities matrices associated to the line of singularities. The latter divide the complex k-plane in eight regions of analiticity. One of these matrices is related to the asymptotic behaviour of scattering state. The other is not. Both being necessary to solve the inverse problem. Besides the usual poles related to bound states there are also other poles associated with total reflexion.

10133 **(IFT-P—01/87) Chiral symmetry breaking in finite quantum electrodynamics.** Montero, J.C.; Pleitez, V. (Instituto de Fisica Teorica, Sao Paulo (Brazil)). 1987. 12p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88700860/JAW.

The dynamical breakdown of chiral symmetry in a finite Abelian gauge theory using a variational approach for the effective potential for composite operators is discussed. It is shown that, at least in a variational approach, the fermion either remains massless or gets a dynamical mass for every non-zero coupling constant.

10134 **(IFT-P—04/87) On exterior variational calculus.** Aldrovandi, R.; Kraenkel, R.A. (Instituto de Fisica Teorica, Sao Paulo (Brazil)). 1987. 16p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88700861/JAW.

Exterior variational calculus is introduced through examples in field theory. It provides a very simple technique to decide on the existence of Lagrangians for given equations of motions and, in the case, to find them. Only local aspects are discussed but the analogy to exterior calculus on finite dimensional manifolds is complete, strongly suggesting its suitability to the study of topological aspects.

10135 **(IFVE-OTF—85-27) Relativistic string theory. 1. Auxiliary spectral problem.** Pron'ko, G.P. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1985. 18p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88700388/JAW.

Submitted to the journal Theor. Math. Phys. .

The theory of relativistic string is considered from the point of view of auxiliary spectral problem. The dynamical variables of string are divided into the external and internal ones and for the former an auxiliary problem is formulated. Futher the spectral properties of this problem are analyzed. The high string equations and the conditions for finite number of lacuna in the auxiliary problem spectrum are introduced. 19 refs.

10136 **(IFVE-OTF—85-28) Relativistic string theory. 2. Action-angle variables.** Pron'ko, G.P. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1985. 15p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88700389/JAW.

Submitted to the journal Theor. Math. Phys. .

Investigation of the relativistic string by means of the method of the auxiliary spectral problem is continued. Variables of the action - angle - type for finite zone string configurations with good trasformation properties relative to the Lorentz group are built out of variables describing main and additional spectra of the auxiliary spectral problem. 8 refs.

10137 **(IFVE-OTF—85-146) Causality in the problem of single-time reduction in quantum field theory.** Arkhipov, A.A. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1985. 25p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88700391/JAW.

The paper is a continuation of the investigations along the lines of constructing a single-time reduction of the Bethe-Salpeter wave function by taking into account the causal and spectral properties of the local quantum field theory. The method is generalized and applied here to two-particle Green functions. 18 refs.

10138 **(IFVE-OTF—85-147) Heisenberg fields in the vicinity of a classical solution.** Tverskoj, V.B. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1985. 16p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88700867/JAW.

Submitted to the journal Theor. Math. Phys. .

The method of quantization in the neighbourhood of the classical solution based on the direct perturbative solution of the Cauchy problem for Heisenberg field equations is considered after the example of non-linear scalar field models in two-dimensional

space-time. Like in classical Bogolubov-Krylov method zero modes are shown to appear as a result of perturbative expansion of Bogolubov's operator-values argument of classical component. With the help of LSZ-procedure a complete investigation of the soliton sector asymptotic states is carried out in the lowest perturbative orders. 18 refs.

10139 **(IFVE-OTF—86-188) On the equivalence of four-dimensional self-duality equations to continual analog of the main chiral field problem.** Leznov, A.N. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1986. 7p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88700871/JAW.

A relationship between self-duality equations in four-dimensional space and the main chiral field problem in n-dimensional space has been established. The general solution of the self-duality equations which depends on the necessary number of the functions of three independent arguments coincides with the general solution of the main chiral field problem when the space dimension goes to infinity. 8 refs.

10140 **(INFN/AE—87-3) Magnetic monopoles without strings by Kaeler-Clifford algebra. Geometrical interpretation of a satisfactory formalism.** Maia, A.; Rodrigues, W.A.; Rosa, M.A.R.; Recami, E. (Istituto Nazionale di Fisica Nucleare, Bari (Italy)). 1987. 11p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88700767/JAW.

In substitution for Dirac monopoles with strings, we have recently introduced monopoles without string on the basis of a generalized potential, the sum of vector A and a psudovector *g*L5 B potential. By making recourse to the (graded) Clifford algebra, which just allows adding together tensors of different rank (e.g., scalars + psudoscalars + vectors + pseudovectors + ...), in a previous paper we succeeded in constructing a lagrangian and hamiltonian formalism for interacting monopoles that can be regarded as satisfactory from various points of view. In the present note, after having completed that formalism, we put forth a purely geometrical interpretation of it within the Kaeler algebra on differential forms, essential ingredients being the natural introduction of a generalized curvature and the Hodge decomposition. We thus pave the way for the extension of our monopoles without string to non-abelian gauge groups. The analogies of this approach with supersymmetric theories are apparent. 20 refs.

10141 **(INIS-BR—905) Critical behaviour of self-dual Z(N) spin systems - Finite size scaling and conformal invariance.** Alcaraz, F.C. (Sao Carlos Univ. (Brazil). Dept. de Fisica). 1986. 37p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88700874/JAW.

Critical properties of a family of self-dual two dimensional Z(N) models whose bulk free energy is exacly known at the self-dual point are studied. The analysis is performed by studing the finite size behaviour of the corresponding one dimensional quantum Hamiltonians which also possess an exact solution at their self-dual point. By exploring finite size scaling ideas and the conformal invariance of the critical infinite system the critical temperature and critical exponents as well as the central charge associated with the underlying conformal algebra are calculated for N up to 8. The results strongly suggest that the recently constructed Z(N) quantum field theory of Zamolodchikov and Fateev (1985) is the underlying field theory associated with these statistical mechanical systems. It is also tested, for the Z(5) case, the conjecture that these models correspond to the bifurcation points, in the phase diagram of the general Z(N) spin model, where a massless phase originates.

10142 (INIS-mf—11054, pp 12) **Quantum electrodynamics of strong fields - new particles.** Greiner, W. (Frankfurt Univ., Germany, F.R.). Sep 1987. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88700772/JAW. (CONF-8709196—).

From Annual convention fo the Austrian Physical Society; Vienna, Austria (21 Sep 1987).

10143 (INIS-mf—11054, pp 70) **Dynamic quarks.** Faber, M.; Feilmair, W.; Markum, H. (Technische Univ., Vienna, Austria). Sep 1987. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88700772/JAW. (CONF-8709196—).

From Annual convention fo the Austrian Physical Society; Vienna, Austria (21 Sep 1987).

10144 (INIS-mf—11054, pp 72) **Meson-meson scattering matrix in the lattice QCD.** Faber, M.; Lahrmann, H.; Markum, H. (Technische Univ., Vienna, Austria). Sep 1987. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88700772/JAW. (CONF-8709196—).

From Annual convention fo the Austrian Physical Society; Vienna, Austria (21 Sep 1987).

10145 **(INS—636) Renormalization group analysis of the temperature dependent coupling constant in massless theory.** Yamada, Hirofumi. (Tokyo Univ., Tanashi (Japan). Inst. for Nuclear Study). Jun 1987. 15p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88751059/JAW.

A general analysis of finite temperature renormalization group equations for massless theories is presented. It is found that in a direction where momenta and temperature are scaled up with their ratio fixed the coupling constant behaves in the same manner as in zero temperature and that asymptotic freedom at short distances is also maintained at finite temperature.

10146 **(ITEP—30(1987)) Factorization of the measure in bosonic string theory in two loops.** Gerasimov, A.A. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1987. 11p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88700891/JAW.

Factorization of the measure in bosonic string theory in two loops is considered. Contribution of tachyonic and massless excitations are computed. It is shown, that the contribution of massless excitations may be interpreted as a sum of squared fermionic propagators with different boundary conditions. 6 refs.; 3 figs.

10147 **(ITEP—55(1986)) Tunneling at finite temperature.** Selivanov, K.G. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1986. 5p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88700892/JAW.

The rate of a metastable vacuum decay at finite temperature in a (1+1)-dimensional scalar field theory is calculated. All the n-particle terms in the decay rate are taken into account. The results can be applied to calculate the dislocation velocity in Peierls potential relief. 7 refs.; 1 fig.

10148 **(ITEP—59(1986)) Two- and three-loop amplitudes in the bosonic string theory.** Belavin, A.; Knizhnik, V.; Morozov, A.; Perelomov, A. (AN SSSR, Moscow. Inst. Teoreticheskoj Fiziki; Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1986. 11p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88700893/JAW.

Explicit formulae are obtained for two- and three-loop vacuum amplitudes in the theory of closed oriented bosonic strings at $\alpha=26$ in terms of the theta-constants, with the module space being parametrized by period matrices. 6 refs.

10149 **(ITEP—133(1986)) On vanishing of vacuum energy for superstrings.** Morozov, A.; Perelomov, A. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1986. 8p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88700894/JAW.

Hypothesis, concerning the structure of formulae for vacuum diagrams in the first-quantized superstring theory is pro-

posed. The analytical measure in the integration over moduli space is proportional to the sum over spin structures on Riemann surfaces and vanishes because of the Riemann identities for Θ-constants. 4 figs.

10150 (JINR—E-2-86-663) Exact solution of the multiflavor Gross-Neveu model. Avdeev, L.V.; Chizhov, M.V. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1986. 10p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88700480/JAW.

Submitted to the journal Phys. Lett. B.

The Polyakov-Wiegmann fermionization of the SU(2) principal chiral field in two dimensions, i.e., the 0(4) sigma model, is fulfilled in a rigorous fashion to the end. Instead of solving a higher-spin fermionic theory, we study the multiflavor chiral-invariant Gross-Neveu model, strictly shown to be equivalent to the initial bosonic theory if the number of flavors tends to infinity. The Bethe-ansatz diagonalization of the relativistic model is performed, the filling of the Dirac sea is accomplished, the physical vacuum and excitations with finite energy and momentum are constructed. A correlation between the two couplings in the model is found necessary. The S-matrix for the massive physical excitations to be the same as in the one-flavor case. This does not corroborate the assumption that the fundamental particles of the sigma model are in the vector representation of O(4). The renormalization-group beta function agrees with a one-charged solution in perturbations theory. 24 refs.

10151 (JINR—E-2-86-735) On the variational formulation of classical Abelian gauge field theories. Karloukovski, V.I. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1986. 5p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88700482/JAW.

It is shown how one can formulate an action principle for classical Abelian gauge theories not by means of gauge potentials and currents but in terms of the gauge invariant field strengths and gauge variant stream potentias. The discussion is on a general formal level in n=s+t space-time dimensions and uses, for brevity, the language of differential forms. 9 refs.

10152 (JINR—E-2-86-744) Application of the Abelian antisymmetric-tensor gauge theories to classical physics. Karloukovski, V.I. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1986. 8p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88700483/JAW.

After a brief review of the development of the Abelian antisymmetric-tensor gauge theories the authors comment on the appearance of such a kind of field in classical electrodynamics as stream potentials. They are related to a somewhat different from the conventional variational formulation of the Abelian gauge theories. The possibility that string-like objects have their natural existence even on a classical level in physics without the need to introduce them is discussed. 31 refs.

10153 (JINR-E—2-86-615) Lattice vortices in the two-dimensional Abelian Higgs model. Grunewald, S.; Ilgenfritz, E.-M.; Mueller-Preussker, M. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Computing Techniques and Automation). 1986. 20p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88700902/JAW.

Submitted to the journal Zeitschrift fur Physic C (Particles and Fields).

Multi-vortices of the 2D Abelian Higgs model on a finite lattice by relaxation of Monte-Carlo equilibrium configurations are generated and identified. The lattice vortices have action and a uniquely defined topological charge corresponding to the continuum ones. They exhibit the expected exponential decay behaviour and satisfy approximately the classical equations of motion. Vortex-antivortex superpositions are seen as well, supporting the dilute gas picture. Single vortices finally relax into "dislocations" and dissapear. A background charge construction turns out nearly insensitive with respect to dislocations. 22 refs.; 6 figs.

10154 (JINR-E—2-86-816) Finite N=1 SUSY gauge field theories. Kazakov, D.I. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1986. 16p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88700903/JAW.

Submitted to the journal J. Modern Phys. A.

The authors give a detailed description of the method to construct finite N=1 SUSY gauge field theories in the framework of N=1 superfields within dimensional regularization. The finiteness of all Green functions is based on supersymmetry and gauge invariance and is achieved by a proper choice of matter content of the theory and Yukawa couplings in the form Y/sub i/=f/sub i/(ϵ)g, where g is the gauge coupling, and the function f/sub i/(ϵ) is regular at ϵ=0 and is calculated in perturbation theory. Necessary and sufficient conditions for finiteness are determined already in the one-loop approximation. The correspondence with an earlier proposed approach to construct finite theories based on aigenvalue solutions of renormalization-group equations is established. 20 refs.

10155 (JINR-R—2-86-689) Direct method deriving a multisoliton solution of the problem of wave interaction on the x,y plane. Mel'nikov, V.K. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1986. 18p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88700912/JAW.

Submitted to the journal Comm. Math. Phys. .

Explicit expressions are found for a multi-soliton solution of the system of equations describing the interaction of waves on the x, y plane. The proof of all necessary statements follows from the theory of matrices and is not based on the inverse scattering method. The obtained results are closely related to some problems of the mathematical physics. 5 refs.

10156 (JINR-R—2-86-798) About the pole structure of a new solution of Chew-Low-type equations. Rerikh, K.V. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1986. 10p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88700913/JAW.

The structure is studied of a new solution of Chew-Low-type equations earlier obtained as series in powers of z=e/sup lnλw/ convergent in a vicinity of the coordinate origin in the plane z. It is shown that these series are transcendental meromorphic functions of z with an infinite number of simple poles at points z=z/sub i/λ/sup k/ where z/sub i/ are roots of a certain equation. The procedure of determining roots and residues at poles is presented. 7 refs.; 2 figs.

10157 (LA-UR—87-3980) Basic physics program for a low energy antiproton source in North America. Bonner, B.E.; Nieto, M.M. (Rice Univ., Houston, TX (USA); Los Alamos National Lab., NM (USA)). 1987. Contract W-7405-ENG-36. 35p. (CONF-8710125—4). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88003148/JAW.

From 2. review and planning workshop on antiproton science and technology; Santa Monica, CA, USA (6 Oct 1987).

We summarize much of the important science that could be learned at a North American low energy antiproton source. It is striking that there is such a diverse and multidisciplinary program that would be amenable to exploration. Spanning the range from high energy particle physics to nuclear physics, atomic physics, and condensed matter physics, the program promises to offer many new insights into these disparate branches of science. It is abundantly clear that the scientific case for rapidly proceeding towards such a capability in North America is both alluring and strong. 38 refs., 2 tabs.

10158 (LAPP-TH—183-87) Kaehler transformations and the coupling of matter and Yang-Mills fields to supergravity. Binetruy, P.; Girardi, G.; Grimm, R.; Mueller, M. (Grenoble Univ., 74 - Annecy-le-Vieux, France. LAPP; CERN, Geneva, Switzerland). (Grenoble-1 Univ., 74 - Annecy (France). Lab. de Physique des Particules). Jan 1987. 11p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88751637/JAW.

It is demonstrated that a geometric interpretation of Kaehler transformations in superspace allows to construct the full action for matter and Yang-Mills fields coupled to supergravity in a concise way, both in terms of superfields and component fields.

10159 (NORDITA—87/32-P-Prepr.) N-Reggeon vertex for the Neveu-Schwarz string. Clarizia, A.; Pezzella, F. (Nordisk Inst. for Teoretisk Atomfysik, Copenhagen (Denmark); International School of Advanced Studies, Trieste (Italy)). Jun 1987. 19p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88751255/JAW.

Two N-Reggeon vertices for the Neveu-Schwarz string are constructed. One is manifestly invariant only under the projective group, while the other has the full super-projective invariance. When they are saturated with physical states they reproduce the correct physical tree scattering amplitudes.

10160 (NORDITA—87/36-P-Prepr.) N string vertex and loop calculation in the bosonic string. Di Vecchia, P.; Frau, M.; Lerda, A.; Sciuto, S. (Nordisk Inst. for Teoretisk Atomfysik, Copenhagen (Denmark); Nordisk Inst. for Teoretisk Atomfysik, Copenhagen (Denmark); Istituto Nazionale di Fisica Nucleare, Turin (Italy); State Univ. of New York, Stony Brook (USA). Inst. for Theoretical Physics; Istituto Nazionale di Fisica Nucleare, Turin (Italy)). 1987. 33p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88751256/JAW.

We construct a BRST invariant twisted propagator and discuss different forms of the N String Vertex. We then use them for constructing loop diagrams in the bosonic string.

10161 (NORDITA—87/39-P-Prepr.) Chance for interaction in λphi/sub 3+1//sup 4/, λ > 0. Paban, S.; Tarrach, R. (Nordisk Inst. for Teoretisk Atomfysik, Copenhagen (Denmark)). 1987. 19p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88751254/JAW.

By variational methods an approximate, nonperturbative, unique, renormalized, interacting effective action for λphi/sup 4// sub 3 + 1/, λ > 0, is obtained. It completes and corrects an earlier result for the effective potential. It opens a door towards interaction.

10162 (NORDITA—87/43-P-Prepr.) Modular invariance in S/sub 3/ symmetric 2D conformal field theories. Ravanini, R. (Nordisk Inst. for Teoretisk Atomfysik, Copenhagen (Denmark); Istituto Nazionale di Fisica Nucleare, Turin (Italy)). Aug 1987. 12p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88751253/JAW.

Using GKO construction, we conjecture a formula for the characters of highest weight irreducible representations of the algebra of conformal models having S/sub 3/ symmetry with spin 4/3 parafermionic currents constructed by Fateev and Zamolodchikov. The modular transformations of these characters are given and modular invariant partition functions are classified. It turns out that an A-D-E classification similar to that found in conformal and N=1 superconformal theories holds. For the particular case of the tricritical 3-state Potts model the connection with Virasoro characters is given.

10163 (RRK—87-10) Comment on the Adler-Bardeen theorem and related problems. Fujikawa, Kazuo. (Hiroshima Univ., Takehara (Japan). Research Inst. for Theoretical Physics). Jun 1987. 13p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88751051/JAW.

Some aspects of the constructive proof of the Adler-Bardeen theorem in the sense of exact bare identities are discussed by using the higher derivative regularization. It is argued that the formal path integral derivation of chiral and scale (counting identity) anomalies is compatible with the construction of those regularized Green's functions. We also comment on the T*-product in the Lagrangian formalism and discuss how the complications associated with the (anomalous) symmetry charges in the operator approach are avoided in a suitably defined path integral formalism.

10164 Contact interactions in closed superstring field theory. Greensite, J.; Klinkhamer, F.R. (San Francisco State Univ., CA, USA. Dept. of Physics and Astronomy; Lawrence Berkeley Lab., CA, USA. Nuclear Science Div.). *Nuclear Physics [Section] B;* **291**: No. 3, 557-582(7 Sep 1987). Contract AC03-81ER40009;AC03-76SF00098.

We show that closed (type II and heterotic) superstring field theories, which are presently formulated without contact interactions in the light-cone gauge, do not have a stable vacuum state. States with arbitrary negative energy can be constructed in these theories; an explicit example is given. Negative energy states imply violation of the supersymmetry relation {Q/sup -A/, Q/sup -/ sup(anti B)} = 2δ/sup A/sup(anti B)H. Using coherent state methods, we show that the super-Poincare algebra is indeed violated by the standard light-cone gauge superstring hamiltonians, since the supercharge anticommutator generates local, 4-string contact interactions at O(λ/sup 2/), where λ is the coupling of the 3-vertex. Contact interactions must therefore be added to the usual hamiltonian to restore supersymmetry and vacuum stability.

10165 Will the next fifteen years of high energy physics match the last fifteen. Bjorken, J.D. (Fermi National Accelerator Lab., Batavia, IL). pp 627-652 of Proceedings of the tenth Hawaii conference in high energy physics. Harris, F.A.; Pakvasa, S. Honolulu, HI; University of Hawaii at Manoa (1986). (CONF-8508139—).

From 10. Hawaii topical conference on particle physics; Honolulu, HI, USA (26 Aug 1985).

The series of Hawaii Conferences in High Energy Physics, provide ample evidence of the spectacular progress that high energy physics has made in the last 15 years. In the beginning of this period the notion of quark substructure of hadrons was, for optimists, very confusing. The symmetries and general dynamical properties of the strong force were classified. But at a more fundamental level the strong interaction was not understood at all. The weak force was described by a well-organized, elegant phenomenology good at the low energies, but clearly inadequate at high energies. This paper discusses the advancements made in high energy physics in the past fifteen years and evaluates the future prospects of high energy physics.

65 PHYSICS II

6510 Nuclear Physics

REFER ALSO TO CITATION(S) 9277, 9343, 10157, 10209, 10365, 10641

10166 (DOE/ER/40032—9) Nuclear structure at intermediate energies: Progress report, April 1, 1986-March 31, 1987. Phillips, G.C.; Mutchler, G.S.; Bonner, B.E. (Rice Univ., Houston, TX (USA). Bonner Nuclear Labs.). 15 Apr 1987. Contract AS05-81ER40032. 119p. NTIS, PC A06/MF A01; 1; GPO Dep. Order Number DE88002796/JAW.

This paper describes the following experimental accomplishments: spin transfer in hyperon production; data analysis of N-bar P annihilation cross sections near N-bar N threshold; data analysis on measurement of the imaginary part of the i = 1 N-bar N S-wave scattering length; and an investigation of the NΔ interaction via the interaction $\pi^+ d \rightarrow \pi^+ pn$.

10167 (INIS-mf—11052, pp vp) Analysis of radioactive nuclei decay schemes by means of eγ coincidence method. Kuznetsov, V.V. (Joint Inst. for Nuclear Research, Dubna, USSR). 1985. (In Russian). NTIS (US Sales Only), PC A19/MF A01. Order Number DE88700667/JAW. (CONF-8509430—).

From International summer school on hyperfine interactions and international study meeting: physics with oriented nuclei; Bechyne, Czechoslovakia (2 Sep 1985).

10168 (INIS-mf—11054, pp 75) **First results of the heavy-ions experiments at CERN.** Rohringer, H. (Oesterreichische Akademie der Wissenschaften, Vienna. Inst. fuer Hochenergiephysik). Sep 1987. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88700772/JAW. (CONF-8709196—).

From Annual convention fo the Austrian Physical Society; Vienna, Austria (21 Sep 1987).

10169 **(JINR—E-4-86-605) Note on hypernuclear lifetimes and production of relativistic hypernuclei.** Zofka, J. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1986. 12p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88700489/JAW.

Status of hypernuclear lifetime data and their physical interpretation are shortly reviewed. Possibilities of measuring them using relativistic ions are briefly considered with regard to the parameters of JINR Dubna facilities. 21 refs.; 3 figs.; 3 tabs.

10170 **(JINR—R-1-86-303) Spectra of relativistic π/sup +-/ mesons and protons in inelastic /sup 22/Ne interactions with photoemulsion nuclei at 4.1 GeV/c per nucleon.** Shabratova, G.S.; Andreeva, N.P.; Anzon, Z.V. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy). 1986. 7p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88700496/JAW.

Relativistic monocharge particles emitted in inelastic collisions of /sup 22/Ne with photoemulsion nuclei at 4.1 GeV/s momentum are divided into π/sup +-/-mesons, protons subjected to interaction, and spectators of nucleus-projectiles - protons, deuterons, tritons. The ratios of π/sup +-/-meson and proton yields, which are the interaction participants, energy spectra, rapidity and escape angles are obtained. Average characteristics of particle spectra in groups of events with different splitting degree of nucleus-target and nucleus-projectile are analyzed. Pulse spectrum of π/sup +-/-mesons is compared with π/sup +-/-meson spectrum in neutron-proton interactions. 7 refs.; 6 figs.; 2 tabs.

10171 **(JINR—R-1-86-464) Inelastic collisions of relativistic nuclei and the uncertainty principle.** Tolstov, K.D. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy). 1986. 5p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88700497/JAW.

The effects observed in relativistic nuclei collisions are considered using the uncertainty principle. The asymmetry of particle emission, i.e. the bounce-off projectile fragments and the side-splash of target fragments, is observed. The transverse momenta of fast particles with increasing the collision centrality. No relativistic particles are observed in the forward cone in some cases of the complete destruction of colliding nuclei. 13 refs.; 2 figs.

10172 **Neutron cross section standards evaluation for ENDF/B-VI.** Carlson, A.D.; Poenitz, W.P.; Hale, G.M.; Peelle, R.W. (National Bureau of Standards, Gaithersburg, MD, USA; Argonne National Lab., Idaho Falls, ID, USA; Los Alamos National Lab., NM, USA; Oak Ridge National Lab., TN, USA). *Radiation Effects;* **96**: No. 1-4, 87-98(Mar 1986). (CONF-850507—).

From International conference on nuclear data for basic and applied science; Santa Fe, NM, USA (13 May 1985).

The neutron cross section standards are now being evaluated as the initial phase in the development of the new ENDF/B-VI file. These standards evaluations are following a somewhat different process compared with that used for earlier versions of ENDF. The primary effort is concentrated on a simultaneous evaluation using a generalized least squares program, R-matrix evaluations, and a procedure for combining the results of these evaluations. The ENDF/B-VI standards evaluation procedure is outlined, and preliminary simultaneous evaluation and R-matrix results are presented.

10173 **Measurements and calculations of neutron scattering angular distributions over a wide mass and energy range.** Hansen, L.F. (Lawrence Livermore National Lab., CA, USA). *Radiation Effects;* **92**: No. 1-4, 83-96(1986). (CONF-850507—).

From International conference on nuclear data for basic and applied science; Santa Fe, NM, USA (13 May 1985).

Neutron elastic and inelastic differential cross sections for targets between ^{9}Be and ^{239}Pu at energies, E > 14 MeV have been measured using the Livermore and Ohio University neutron time-of-flight facilities. The data are reviewed and compared with that of other workers.

10174 **Measurement and evaluation of selected 14-MeV neutron cross sections for fusion.** Meadows, J.W.; Smith, D.L.; Cox, S.A. (Argonne National Lab., IL, USA). *Radiation Effects;* **92**: No. 1-4, 123-128(1986). (CONF-850507—).

From International conference on nuclear data for basic and applied science; Santa Fe, NM, USA (13 May 1985).

Experimental neutron-activation cross-section data in the vicinity of 14 MeV are evaluated for several reactions of fusion-related interest using a least-squares method. New experimental measurements are performed at 14.7 MeV for all of these considered reactions and for some commonly-used standard reactions as well. Comparison is made between measured and evaluated results.

10175 **New neutron cross sections for fusion materials studies.** Greenwood, L.R.; Smither, R.K. (Argonne National Lab., IL, USA). *Radiation Effects;* **92**: No. 1-4, 163-166(1986). (CONF-850507—).

From International conference on nuclear data for basic and applied science; Santa Fe, NM, USA (13 May 1985).

Neutron cross sections are being developed for a variety of fusion-related applications including: neutron dosimetry, fusion plasma diagnostics, the activation of very long-lived isotopes, and high-energy accelerator neutron sources.

10176 **REAC nuclear data libraries.** Mann, F.M.; Lessor, D.E.; Pintler, J.S. (Hanford Engineering Development Lab., Richland, WA, USA). *Radiation Effects;* **92**: No. 1-4, 207-210(1986). (CONF-850507—).

From International conference on nuclear data for basic and applied science; Santa Fe, NM, USA (13 May 1985).

The activation code REAC requires two nuclear data libraries, one containing multigroup reaction cross sections and the other decay data. Cross sections for over 300 isotopes are included in the cross section library, resulting in over 6000 reactions. Over 90% of the stable isotopes are all unstable isotopes with half lives greater than 5 years and masses less than 220 amu are included. All isotopes, reached by the reactions in the cross section libraries are included in the decay library.

10177 **Benchmark assemblies of the Los Alamos critical assemblies facility.** Dowdy, E.J. (Los Alamos National Lab., NM, USA). *Radiation Effects;* **93**: No. 1-4, 269-272(1986). (CONF-850507—).

From International conference on nuclear data for basic and applied science; Santa Fe, NM, USA (13 May 1985).

Several critical assemblies of precisely known materials composition and easily calculated and reproducible geometries have been constructed at the Los Alamos National Laboratory. Some of these machines, notably Jezebel, Flattop, Big Ten, and Godiva, have been used as benchmark assemblies for the comparison of the results of experimental measurements and computation of certain nuclear reaction parameters. These experiments are used to validate both the input nuclear data and the computational methods. The machines and the applications of these machines for integral nuclear data checks are described.

6511 Experimental Techniques

REFER ALSO TO CITATION(S) 9385, 10071

10178 **(CONF-8706128—4) Development of an optically pumped polarized deuterium target.** Young, L.; Holt, R.J.; Green, M.C.; Kowalczyk, R. (Argonne National Lab., IL (USA)). 1987. Contract W-31109-ENG-38. 3p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88003064/JAW.

From 8. international conference on laser spectroscopy; Are, Sweden (22 Jun 1987).

The development of a polarized deuterium target for internal use at an electron storage ring is of great interest for fundamental studies in nuclear physics. In order to achieve the maximum allowable target thickness, 10^{14} nuclei/cm^2, consistent with various constraints imposed by the storage ring environment, a flux of 4×10^{17} polarized atom/s must be provided. This flux exceeds the capability of conventional atomic beam sources by an order of magnitude. We have been developing an alternative source based upon the spin-exchange optical pumping method in which the flux is limited only by laser power. 7 refs., 1 fig.

10179 **(LBL—24035) Beta-delayed two-proton emission as a nuclear probe.** Moltz, D.M.; Reiff, J.E.; Robertson, J.D.; Lang, T.F.; Cerny, J. (Lawrence Berkeley Lab., CA (USA)). Sep 1987. Contract AC03-76SF00098. 9p. (CONF-870970—10). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88003191/JAW.

From 5. international conference on nuclei far from stability; Lake Rosseau, Canada (14 Sep 1987).

A brief history of beta-delayed two-proton emission is given. Speculations about future experiments which would enhance our knowledge about both nuclear spectroscopy and this relatively unique decay mode are presented. 16 refs., 7 figs.

6512 Nuclear Properties And Reactions, A=1-5, Experimental

10180 **(INIS-mf—10750) Proton-induced collinear deuteron breakup at 7.5 MeV.** Lekkas, P. (Bochum Univ. (Germany, F.R.). Fakultaet fuer Physik und Astronomie). 26 Jun 1985. 106p. (In German). NTIS (US Sales Only), PC A06/MF A01. Order Number DE88751024/JAW.

The aim of the present thesis was to study the proton-induced deuteron breakup at an incident energy of 7.5 MeV in collinear geometry. In kinematically complete experiments in which two of the three particles of the exit channel are detected in coincidence we determined in equal kinematics the breakup cross section of the three-particle reactions /sup 2/H(p,pp)n and /sup 2/H(p,np)p. In both cases we observed in the region of the collinearity point an - indeed only weak - increasement of the cross section. The collinearity occurs in the neighbourhood of the QFS. Faddeev calculations with two different nucleon-nucleon interactions describe in the collinearity point the shape of the spectra well. Also the absolute quantity of the measured data in this point is well confirmed for the reaction /sup 2/H(p,pp)n, less well however for the reaction /sup 2/H(p,np)p. If in the theory three-nucleon forces are implemented their influence in the collinearity point is proved to be quantitatively weak. The collinear region is from the results of the present thesis especially because of the closely adjacent QFS little significant for three-body forces. (orig./HSI).

10181 (INIS-mf—11054, pp 69) **Measurement of muon capture in deuterium.** Cargnelli, M.; Breumlich, W.; Fuhrmann, H.; Kammel, P.; Marton, J.; Pawlek, P.; Werner, J.; Zmeskal, J.; Petitjean, C.; Bertl, W. (Oesterreichische Akademie der Wissenschaften, Vienna; Eidgenoessische Technische Hochschule, Zurich, Switzerland). Sep 1987. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88700772/JAW. (CONF-8709196—).

From Annual convention fo the Austrian Physical Society; Vienna, Austria (21 Sep 1987).

10182 **(ITEF—65-1986) Determination of nuclear vertex function /sup 3/He->ppn from the /sup 3/Hep->pppn reaction at 2.5 and 5 GeV/c momentum of /sup 3/He incident nuclei.** Blinov, A.V.; Vanyushin, I.A.; Grechko, V.E. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1986. 35p. (In Russian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88700446/JAW.

The nuclear vertex function of /sup 3/He -> ppn decay has been determined on the basis of experimental data on the /sup 3/Hep -> pppn reactions with /sup 3/He nuclei momenta 2.5 and 5 GeV/c. Data have been obtained in 4π-geometry by means of the IHEP liquid-hydrogen bubble chamber 80 cm in diameter exhibited in separated /sup 3/He nuclei beams with 2.5 and 5 GeV/c momenta. The method for obtaining the nuclear vertex function is based in detail. For the first time the nuclear vertex function of /sup 3/He -> ppn decay has been investigated simultaneously as a function of two Jacobi momenta with explicit separation of its singlet contribution. Such integral characteristics as neutron, proton, pp- and pn-pair pulse distributions in /sup 3/He nucleus are determined. The results obtained are compared with literature data and theoretical calculations carried out with wave functions for the Reid and Yamaguchi potentials. 35 refs.; 10 figs.; 6 tabs.

10183 **(JINR—R-1-86-729) Description of the /sup 1/H(d,p)X reaction at relativistic energies of deuterons in the hard collision model.** Azhgirej, L.S.; Razin, S.V.; Yudin, N.P. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Computing Techniques and Automation). 1986. 16p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88700502/JAW.

Submitted to the journal Yad. Fiz. .

The momentum spectrum of protons emitted at an angle of 0.139 rad in the fragmentation of 9 GeV/c deuterons on hydrogen nuclei is analysed in the framework of the relativistic hard model. Both the elastic and inelastic interactions of deuteron nucleons with target protons are taken into account. On the whole the relativistic hard collision model well describes the general features of proton spectrum. The better agreement with the experiment is obtained by using the deuteron structure function with arguments independently describing longitudinal and trasverse motions of nucleons in deuterons. 26 refs.

10184 (KEK—86-13, pp 93-101) **Measurement of the cross section for γd -> π/sup 0/d in a backward region.** Miyachi, T. (Tokyo Univ., Tanashi, Japan. Inst. for Nuclear Study). Mar 1987. NTIS (US Sales Only), PC A09/MF A01. Order Number DE88780031/JAW. (CONF-8701101—).

From Symposium on hadron spectroscopy; Oho, Ibaraki, Japan (8 Jan 1987).

A primitive motivation of the present work is to look for an experimental evidence of the dibaryon resonances of isospin one, because an effect of the dibaryon resonances is expected to appear in the behavior of differential cross sections for the reaction γd -> π/sup 0/d at large angles. The report present differential cross sections for the reaction γd -> π/sup 0/d in the kinematical region $E\gamma$ = 500 to 1000 MeV and θc.m. = 90 deg to 156 deg. The experimental data are compared with cross sections calculated by a constituent model. Diagrams are shown which can interprete the dynamical properties of the above reaction in the photon energy region $E\gamma$ = 500 to 750 MeV. The elementary processes occuring on the nucleon inside the deuteron are well approximated by phenomenological amplitudes obtained on-shell; the Metcalf-Walker amplitudes for γN -> πN and the phase-shift amplitudes for πN -> πN. To describe the deuteron state, a deuteron wave function based on the Paris potential may be used. Then the observed data are well reproduced within the experimental accuracy. Consequently it is argued that cross section at large angles are described almost entirely by the double-scattering term. Within the experimental accuracy there are no positive indication for the possible existence of the dibaryon resonances of a mass around 2.5 GeV. In the energy region $E\gamma$ = 750 to 1000 MeV, any significant structure is found in the observed results. This implies that the reaction γd -> π/sup 0/d occurs through a mechanism similar to that an $E\gamma$ greater than 750 MeV. (Nogami, K.).

6513 Nuclear Properties And Reactions, A=6-19, Experimental

10185 **(BNL—40158) Comparative studies in direct slow-neutron capture calculations.** Mughabghab, S.F. (Brookhaven National Lab., Upton, NY (USA)). Aug 1987. Contract AC02-76CH00016. 10p. (CONF-8708101—13). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88002632/JAW.

From 6. international symposium on capture gamma-ray spectroscopy; Leuven, Belgium (31 Aug 1987).

Primary E1 transitions due to thermal neutron capture by the nuclides ^{9}Be, /sup 32,34/S, /sup 40,42,44,46,48/Ca, and ^{58}Ni are quantitatively interpreted by the Lane-Lynn formula and are compared with recent optical model calculations. The two approaches are equivalent provided the internal region of the nucleus is excluded in the optical model approach. Theoretical justifications for such a procedure are briefly presented. 32 refs., 4 tabs.

10186 **(GANIL-T—87-01) Study of Beta-Delayed Neutron Emission by Neutron-Rich Nuclei and Analysis of the Nuclear Reaction Mechanism responsible for the Yields of these Nuclei.** Bazin, D. (Grand Accelerateur National d'Ions Lourds (GANIL), 14 - Caen (France)). Jul 1987. 88p. (In French). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88751609/JAW.

Among the nuclear mechanisms used for the production of nuclei far from stability, the projectile fragmentation process has recently proved its efficiency. However, at Fermi energies, one has to take into account some collective and relaxation effects which drastically modify the production cross-sections. The spectroscopic study of very neutron-rich nuclei is very dependent of these production rates. A study of beta-delayed neutron emission which leads to new measurements of half-lives and neutron delayed emission probabilities is achieved with a liquid scintillator detector. The results which are then compared to different theories are of interest for the understanding of natural production of heavy elements (r processus).

10187 (INIS-mf—11054, pp 77) **Measurement and analysis of the elastic- and inelastic alpha scattering on light nuclei.** Abele, H.; Neu, R.; Leitner, W.; Plappert, H.; Striebel, C.; Staudt, G.; Walz, M. (Tuebingen Univ., Germany, F.R. Physikalisches Inst.). Sep 1987. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88700772/JAW. (CONF-8709196—).

From Annual convention fo the Austrian Physical Society; Vienna, Austria (21 Sep 1987).

10188 **(INS—639) Strong rotational coupling effects on the transition /sup 17/O(/sup 16/O, /sup 16/O)/sup 17/O*(0.87 MeV, 1/2/sup +/) between nucleon molecular orbitals.** Imanishi, B.; Misono, S.; Oertzen, W. von. (Tokyo Univ., Tanashi (Japan). Inst. for Nuclear Study). Jul 1987. 17p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88751062/JAW.

It is pointed out that the rotational coupling interactions play essential role in the transition between nucleon molecular orbitals leading to the excitation of /sup 17/O*(0.87 MeV;1/2/sup +/) in the scattering of /sup 16/O on /sup 17/O.

10189 **Double differential neutron emission cross sections of ^{10}B and ^{11}B at 6, 10 and 14 MeV and of ^{6}Li, ^{7}Li and ^{12}C at 14 MeV.** Drosg, M.; Lisowski, P.W.; Hardekopf, R.A.; Drake, D.M.; Treiti, K. (Los Alamos National Lab., NM, USA; Vienna Univ., Austria; Vienna Univ., Austria. Inst. fuer Experimentalphysik). *Radiation Effects;* **92**: No. 1-4, 145-150(1986). (CONF-850507—).

From International conference on nuclear data for basic and applied science; Santa Fe, NM, USA (13 May 1985).

Neutron emission spectra of ^{10}B and ^{11}B were measured at 6, 10 and 14.1 MeV and those of ^{6}Li, ^{7}Li and carbon at 14.1 MeV using time-of-flight techniques. Absolute double differential cross sections were obtained by using scattering from hydrogen as a cross section reference. Integration over energy ranges and solid angle yielded integrated elastic and total neutron emission cross sections. At 6 and 10 MeV excellent agreement with total cross section data is found. The biggest error source in the continuous spectra stems from uncertainties in the input library (ENDF/B-V) of the Monte Carlo correction for multiple scattering.

10190 **Measurements of the ^{10}B(n,He) reaction rate in ZPPR.** Oliver, B.M.; Farrar, H. IV; Brumbach, S.B.; Maddison, D.W.; Collins, P.J. (Rockwell International Corp., Canoga Park, CA, USA; Argonne National Lab., Idaho Falls, ID, USA). *Radiation Effects;* **93**: No. 1-4, 289-292(1986). (CONF-850507—).

From International conference on nuclear data for basic and applied science; Santa Fe, NM, USA (13 May 1985).

Direct measurements of the ^{10}B(n,He) reaction rate have been made in ZPPR. The measurements were made by isotope-dilution mass spectrometric analysis of stainless-steel-encapsulated samples of enriched ^{10}B. The results demonstrate that direct measurements of the ^{10}B reaction rate in ZPPR are obtainable to an accuracy of approx. 1%. Comparisons with calculations give a predicted-to-experiment value of approx. 0.93. This value is consistent with earlier Rockwell measurements in benchmark neutron fields and further supports a need for revision in the ENDF/B cross section for ^{10}B above approx. 0.1 MeV.

6514 Nuclear Properties And Reactions, A=20-38, Experimental

10191 **(DOE/ER/01505—104) Deexcitation processes in nuclear reactions: [Annual progress report], August 1, 1986-July 31, 1987.** Porile, N.T. (Purdue Univ., Lafayette, IN (USA). Dept. of Chemistry). 1987. Contract AC02-76ER01505. 14p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88002355/JAW.

This proposal is organized in two sections, a summary of the principal research accomplishments achieved during the past three years and a description of the proposed research. The chief accomplishments are: study of fragment emission in the interaction of xenon and krypton with 50 to 300 GeV protons, study of fragment emission in the interaction of xenon with 1 to 20 GeV/c protons, design and construction of a central tracking chamber, studies of the interaction of 400 to 800 GeV protons with complex nuclei, measurement of the recoil properties of pion-induced spallation products. Proposed research involves measurement of cross sections and mean ranges of products of the interaction of copper and silver with 15 to 45 MeV/c ^{12}C ions, study of the interaction of heavy ions with targets from vanadium to gold, use of activation techniques to study the production and interaction of anomalous projectile fragments. (JDH)

10192 **(IPNO-DRE—84-41) Observation of compound nuclei at very high temperatures.** Auger, G.; Jouan, D.; Plagnol, E.; Pougheon, F.; Naulin, F.; Doubre, H.; Gregoire, C. (Paris-11 Univ., 91 - Orsay, France. Inst. de Physique Nucleaire; GANIL, 14 - Caen, France). (Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire). 1984. 12p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88751613/JAW.

Analysis of data collected with /sup 40/Ar beam shows strong evidence for the formation of very excited compound nuclei: (this letter will concentrate on the results obtained at 19.5 MeV/A for the /sup 40/Ar + /sup 27/Al system). Incomplete linear momentum transfer remains small and the temperatures obtained can be estimated between 6 and 7 Mev.

10193 **(ISN—87-52) Light particle correlations with /sup 20/Ne at 30 MeV/A on different targets.** Merchez, F.; Kox, S.; Gondrand, J.C.; Mistretta, J.; Perrin, C.; Gretillat, P.; Schwarz, E. (Grenoble-1 Univ., 38 (France). Inst. des Sciences Nucleaires). Jan 1987. 8p. (CONF-870153—). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88750671/JAW.

From 25. international winter meeting on nuclear physics; Bormio, Italy (19 Jan 1987).

First measurements of light particle correlations at very small relative angles (0.1/sup 0/) had been obtained with the specif-

ic interferometer EMRIC at SARA. This first analysis will emphasize the interest of such an angular resolution.

6515 Nuclear Properties And Reactions, A=39-58, Experimental

10194 **(AERE-R—12078) Investigation of the reaction mechanism for resonance neutron capture in ^{54}Fe and ^{62}Ni.** Mason, J.P. (UKAEA Atomic Energy Research Establishment, Harwell. Nuclear Physics Div.). Jan 1986. 129p. (NEANDC(UK)—176/A; INDC(UK)—040/G). NTIS (US Sales Only), PC A07/MF A01. Order Number DE88750693/JAW.

The gamma-ray spectra produced following neutron capture in the low energy resonances of ^{54}Fe and ^{62}Ni have been observed, using the Harwell 136 MeV electron linear accelerator facility, HELIOS, as a source of pulsed neutrons. The work indicated that, for s-wave capture in the mass region A approx. 55, single particle effects may only be apparent if the size of the valence component is about an order of magnitude larger than the compound nuclear component, and that this may limit the importance of such effects to a few nuclides. In addition, some information was obtained on the radiative decay of p-wave resonances of ^{54}Fe and ^{62}Ni.

10195 **(DOE/ER/40339—T1) Fast neutron cross section measurements: First year progress report.** (Michigan Univ., Ann Arbor (USA)). [1987]. Contract FG02-87ER40339. 69p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE88002379/JAW.

Progress on the project has generally followed the schedule included in the three year grant proposal of a year ago. In the 14 MeV Neutron Laboratory, we have completed the last of our current set of activation cross section measurements, and have moved into the phase of rebuilding our accelerator to produce pulses of one nanosecond width. This renovation has required extensive changes in the laboratory, including the relocation of the 150 kV accelerator to a balcony overlooking the main part of the Neutron Bay. We have procured and installed a 90° bending magnet, and are currently fabricating the major components of the beam pulsing system. We expect that the fabrication work will be completed near the end of the current contract year, and intend to move into initial testing of the system shortly after the start of the second contract year. In the Photoneutron Laboratory, we have demonstrated the feasibility of a series of radiochemical separations that are an essential part of our effort to carry out measurements of the U-238 capture cross section. We have also demonstrated the accuracy of a new technique to calibrate our gamma detector efficiency using alpha particle spectrometry. We are now fabricating the uranium targets for this experiment and expect that first year irradiations will take place within the next several months.

10196 **(INIS-mf—10749) Correlations of fragments and their sequential products from the /sup 3/He-induced reaction on /sup 58/Ni at 130 MeV.** Stockhorst, H. (Bonn Univ. (Germany, F.R.). Mathematisch-Naturwissenschaftliche Fakultaet). 22 Oct 1986. 168p. (In German). NTIS (US Sales Only), PC A08/MF A01. Order Number DE88751023/JAW.

The /sup 3/He breakup on the /sup 58/Ni nucleus was studied with a projectile energy of 130 MeV. The main topic of this studies lies thereby on the absorptive breakup in which a fragment from the /sup 3/He breakup is absorbed by the target nucleus. Beside the single and coincidence measurements on the /sup 3/He breakup on the one hand the reaction /sup 58/Ni(d,pp') was studied at a projectile energy of 80 MeV and on the other hand the inclusive reactions /sup 58/Ni(d,yX) and /sup 58/Ni(p,yX) whereby the light particles y up to A=3 were spectroscoped in a wide angular range. The projectile energies were selected in such a way that they correspond almost to the energies of the primary fragments deuteron and proton from the /sup 3/He breakup (E/sub d/=79 MeV and E/sub p/=39 MeV). The study of the elastic /sup 3/He breakup resulted that the shapes of the deuteron and proton spectra can be well described by a PWBA model and reproduce the momentum distribution of the fragments before the /sup 3/He breakup. The spectra are therefore determined by properties of the projectiles. However the proton and deuteron spectra from the absorptive breakup show distinct components which cannot be reduced to /sup 3/He properties. Rather they are in their shape comparable with the inclusive spectra of the (d,p) respectively (p,p') reaction. Especially this is valid for spectra from the /sup 3/He breakup in which a fragment was registrated with an energy corresponding to the projectile velocity. This suggests that in the absorptive /sup 3/He breakup a two-stage process is present in which after the /sup 3/He fragmentation in a second stage a (d,p) or (p,p') reaction occurs. The study of the /sup 3/He breakup resulted that such processes yield an essential contribution to the inclusive cross section of the reactions /sup 58/Ni(/sup 3/He,dX) and /sup 58/Ni(/sup 3/He,pX). (HSI).

10197 **(ORNL/TM—10417) Calculated neutron-induced cross sections for ^{52}Cr from 1 to 20 MeV and comparisons with experiments.** Hetrick, D.M.; Fu, C.Y.; Larson, D.C. (Oak Ridge National Lab., TN (USA)). 15 Sep 1987. Contract AC05-84OR21400. 69p. (ENDF—346). NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE88003734/JAW.

Nuclear model codes were used to compute cross sections for neutron-induced reactions on ^{52}Cr for incident energies from 1 to 20 MeV. The input parameters for the model codes were determined through analysis of experimental data in this energy region. Discussion of the models used, the input data, the resulting calculations, extensive comparisons to measured data, and comparisons to the Evaluated Nuclear Data File (ENDF/B-V) for Cr (MAT 1324) are included in this report. 103 refs., 67 figs., 12 tabs.

10198 **Status of the parameters of the 1.15-keV resonance of ^{56}Fe.** Perey, F.G. (Oak Ridge National Lab., TN, USA). *Radiation Effects;* **96**: No. 1-4, 181-186(Mar 1986). (CONF-850507—). Contract AC05-84OR21400.

From International conference on nuclear data for basic and applied science; Santa Fe, NM, USA (13 May 1985).

Following the Antwerp Conference, a task force was appointed by the Nuclear Energy Agency Nuclear Data Committee (NEANDC) to investigate discrepancies in parameters of the 1.15-keV resonance of ^{56}Fe. This task force has not completed its investigations. The status of various transmission and capture experiments is reviewed.

10199 **High-resolution structural material (n,xγ) production cross sections for 0.2 < Esub(n) < = 40 MeV.** Larson, D.C. (Oak Ridge National Lab., TN, USA). *Radiation Effects;* **92**: No. 1-4, 71-82(1986). (CONF-850507—). Contract AC05-84OR21400.

From International conference on nuclear data for basic and applied science; Santa Fe, NM, USA (13 May 1985).

Cross-section results are presented for /sup nat/Cr(n,xγ), ^{56}Fe(n,xγ) and ^{58}Ni(n,xγ), obtained at the Oak Ridge Electron linear Accelerator. A good estimate of the total inelastic scattering cross section is obtained from the production cross section of the gamma ray corresponding to de-excitation of the first 2^+ level in the even-even nuclides studied. In addition, cross sections for production of gamma rays resulting from tertiary reactions are measured, thus obtaining scarce cross-section information about these reactions.

10200 **Fast-neutron interaction with niobium.** Smith, A.B.; Guenther, P.T.; Poenitz, W.P.; Smith, D.L.; Whalen, J.F.; Howerton, R.J. (Argonne National Lab., IL, USA; Lawrence Livermore National Lab., CA, USA). *Radiation Effects;* **92**: No. 1-4, 129-132(1986). (CONF-850507—).

From International conference on nuclear data for basic and applied science; Santa Fe, NM, USA (13 May 1985).

Results of a comprehensive study of the interaction of fast neutrons with niobium are presented, including measurement and interpretation of neutron total, differential-scattering and radiative-capture cross sections. The experimental results are interpreted in the context of the optical-statistical model, with attention to the Fermi-surface anomaly. Experimental results, physical interpretations and rigorous statistical methods are used to provide a comprehensive evaluated nuclear data file suitable for use in a wide range of applied neutronic calculations.

10201 **Burn-up cross sections of ^{51}Cr, ^{59}Fe, ^{65}Zn, ^{86}Rb, ^{103}Ru.** Katcoff, S. (Brookhaven National Lab., Upton, NY, USA). *Radiation Effects;* 93: No. 1-4, 221-224(1986). (CONF-850507—).

From International conference on nuclear data for basic and applied science; Santa Fe, NM, USA (13 May 1985).

Targets of Cr, Fe, Zn, Rb, and Ru were irradiated in the hydraulic tube of the Oak Ridge HFIR reactor at a neutron flux of 2.6 x 10^{15} n/cm^{2}sec for 1 day and 20 days. The reactor burn-up cross sections (in barns) of the radioactive product nuclides are: ^{51}Cr, <10; ^{59}Fe, <10; ^{65}Zn, 60+-30; ^{86}Rb, <20; ^{103}Ru, <20.

6516 Nuclear Properties And Reactions, A=59-89, Experimental

10202 **(CALT—63-463) A low background study of Ge^{76} neutrinoless double beta decay in the St. Gotthard tunnel.** Fisher, P. (California Inst. of Tech., Pasadena (USA)). 25 Mar 1986. Contract AS03-81ER40002. 7p. NTIS, PC A02. Order Number DE88002774/JAW.

A high purity germanium detector has been run in an underground laboratory for a period of 6728 hours, giving a lower limit for the half-life of Ge^{76} neutrinoless double beta decay of t/sub 1/2/ ≧ 3.2 x 10^{23} years (90% cl) or 6.2 x 10^{22} years (68% cl).

10203 **(CONF-871186—4) Description of evaluation for / sup 63,65/Cu for ENDF/B-VI.** Larson, D.C.; Hetrick, D.M.; Fu, C.Y. (Oak Ridge National Lab., TN (USA)). 1987. Contract AC05-84OR21400. 11p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88002535/JAW.

From Meeting on the international nuclear data library for fusion reactor technology; Vienna, Austria (16 Nov 1987).

Isotopic evaluations for /sup 63,65/Cu performed for ENDF/B-VI are briefly reviewed. The evaluations are based on analysis of experimental data and results of model calculations which reproduce the experimental data. Evaluated data are given for neutron-induced reaction cross sections, angular and energy distributions, and for gamma-ray production cross sections associated with the reactions. File 6 formats are used to represent energy-angle correlated data and recoil spectra. Uncertainty files are included for the major cross sections. Full evaluations are given for / sup 63,65/Cu.

10204 (INIS-mf—11052, pp vp) **G-factors of isomeric neutron g/sub 9/2/-states in /sup 69,71/Zn.** Herzog, P.; Daemmrich, U.; Freitag, K.; Herrmann, C.D.; Schloesser, K. (Bonn Univ., Germany, F.R. Inst. fuer Strahlen- und Kernphysik). 1985. NTIS (US Sales Only), PC A19/MF A01. Order Number DE88700667/JAW. (CONF-8509430—).

From International summer school on hyperfine interactions and international study meeting: physics with oriented nuclei; Bechyne, Czechoslovakia (2 Sep 1985).

10205 **(JINR—R-1-86-733) Study on central and peripheral interactions of /sup 12/C(3.6 GeV/nucleon) with Cu, Pb nuclei.** Anikina, M.Kh.; Vardenga, G.L.; Golokhvastov, A.I. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy). 1986. 10p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88700503/JAW.

Submitted to the journal Yad. Fiz. .

The yields of protons, deuterons, tritons in nuclear collisions of /sup 12/C + Cu, /sup 12/C + Pb have been measured at 37 deg and 90 deg lab. angles. The collisions of C with a target are classified as central or peripheral depending on the presence of charged particles within +-1.5 deg emission angle relatively to / sup 12/C beam. It is shown that the basic characteristics of proton, deuteron, triton spectra are similar for both types of collisions wich is connected with a weak selectivity of the used event type criterium. The data obtained are compared with the Dubna version of cascade model calculations taking into account the proton, deuteron production as the result of coalescence. It is shown that the model describes the basic experimental results. 4 refs.

10206 **Difficulties with inferring neutron cross sections from charged-particle reactions.** Gardner, D.G.; Gardner, M.A. (Lawrence Livermore National Lab., CA, USA). *Radiation Effects;* 96: No. 1-4, 187-190(Mar 1986). (CONF-850507—). Contract W-7405-ENG-48.

From International conference on nuclear data for basic and applied science; Santa Fe, NM, USA (13 May 1985).

We have investigated problems associated with inferring cross sections for neutron reactions on unstable nuclei in the mass-90 region from charged-particle reactions on nearby stable targets. We conclude that effects due to precompound evaporation, isospin, and multiple reaction paths severely limit the circumstances under which charged-particle studies may be directly and easily converted to neutron cross sections of useful accuracy.

10207 **Photon production cross section measurements for Ta and Be.** Gould, C.R.; Dave, J.; Mitchell, G.E.; Ramakrishnan, P.; Auchampaugh, G.F.; Little, R.C.; Wender, S.A. (North Carolina State Univ., Raleigh, USA; Triangle Universities Nuclear Lab., Durham, NC, USA; Los Alamos National Lab., NM, USA). *Radiation Effects;* 92: No. 1-4, 139-144(1986). (CONF-850507—).

From International conference on nuclear data for basic and applied science; Santa Fe, NM, USA (13 May 1985).

Gamma-ray production cross sections have been measured in the 2-25 MeV energy range for Ta and Be using the 0-100 MeV white neutron source facility WNR at Los Alamos. Calculations of neutron induced backgrounds are discussed. Results for Ta are compared with previous measurements from Oak Ridge National Laboratory.

10208 **Capture in the 1.15-keV iron resonance.** Weston, L.W.; Todd, J.H. (Oak Ridge National Lab., TN, USA). *Radiation Effects;* 93: No. 1-4, 249-252(1986). (CONF-850507—). Contract AC05-84OR21400.

From International conference on nuclear data for basic and applied science; Santa Fe, NM, USA (13 May 1985).

The 1.15-keV resonance in iron is important to fast reactors in that a major part of the iron capture integral is due to this one resonance. This resonance is also a good test case for capture gamma-ray detectors, which are meant to have an efficiency independent of gamma-ray energy spectra, because this resonance has an unusually hard spectrum and other iron resonances do not. There have been severe discrepancies among different groups who have measured the capture area and transmission of this resonance. A new measurement, employing C_6F_6 liquid scintillators and pulse-height weighting to effect total energy detection, has been made of the ratio of the capture area of the 22.8-keV resonance relative to that of the 1.15-keV resonance. The 22.8-keV resonance has a relatively soft gamma-ray spectrum and there is agreement on the capture area. The results agree well with transmission measurements and confirm the applicability of total energy detectors for use on capture resonances with very hard capture gamma-ray spectra.

10209 **Delayed neutron data from TRISTAN.** Warner, R.A.; Reeder, P.L. (Pacific Northwest Lab., Richland, WA, USA). *Radiation Effects;* 94: No. 1-4, 27-32(1986). (CONF-850507—).

From International conference on nuclear data for basic and applied science; Santa Fe, NM, USA (13 May 1985).

Half-lives and P/sub n/ values are presented for 38 precursors among the low yield fission products. P/sub n/ values are based on a beta-neutron coincidence technique.

6517 Nuclear Properties And Reactions, A=90-149, Experimental

10210 **(DOE/OR/10494—8) Radioactive decay and nuclear structure studies: Progress report, October 1, 1986 through September 30, 1987.** Walters, W.B. (Maryland Univ., College Park (USA). Dept. of Chemistry). 1987. Contract AS05-79ER10494. 92p. NTIS, PC A05/MF A01; 1; GPO Dep. Order Number DE88002103/JAW.

New data are presented for the level structures of ^{143}Ba, ^{147}Ce, ^{147}Pr, ^{143}Ca, ^{133}Sb, ^{130}Sb, ^{129}Sb, ^{130}Te, and ^{129}Te. New con-

version electron and gamma-ray coincidence measurements are reported for the even-even ^{116}Xe, ^{130}Xe, ^{132}Xe, ^{134}Xe nuclides which include the identification of a number of new E0 transitions. New values for the magnetic moments in ^{77}Br, ^{75}Br, and ^{74}Br are presented. The results for each of these nuclides are discussed.

10211 (INIS-mf—11052, pp vp) **Collinear laser spectroscopy of indium and tin isotopes.** Klepper, O. (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt, Germany, F.R.). 1985. NTIS (US Sales Only), PC A19/MF A01. Order Number DE88700667/JAW. (CONF-8509430—).

From International summer school on hyperfine interactions and international study meeting: physics with oriented nuclei; Bechyne, Czechoslovakia (2 Sep 1985).

10212 **(ISN—85-78) /sup 124/Ba decay to the /sub 55// sup 124/Cs/sub 69/ low-spin levels.** Weiss, B.; Liang, C.F.; Paris, P.; Gizon, A. (Grenoble-1 Univ., 38 (France). Inst. des Sciences Nucleaires). Sep 1985. 48p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88750667/JAW.

The decay of /sup 124/Ba to the levels of odd-odd /sup 124/Cs has been studied with on-line mass-separated sources delivered at the ISOCELE facility. The energy level scheme has been established from γ-ray singles, γ-γ-t coincidence and e-γ-t coincidence spectra. Spin and parity of several low-lying levels have been assigned on the basis of internal conversion coefficient measurements and β-branchings. A completely new level pattern including approximately 50 levels and /sup 180/ γ-rays is proposed for /sup 124/Cs. Several features of this level scheme are discussed and compared to those of neighbouring isotopes.

10213 **(LBL—23991) Decay studies of neutron deficient rare earth isotopes with OASIS.** Gilat, J.; Nitschke, J.M.; Wilmarth, P.A.; Vierinen, K.; Firestone, R.B. (Lawrence Berkeley Lab., CA (USA)). Sep 1987. Contract AC03-76SF00098. 11p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88002739/JAW.

We report results on the decay of ^{124}Pr, /sup 124,125/Ce, /sup 124,125/La, /sup 134-136/Eu, /sup 134-136/Sm, /sup 134-136/Pm, ^{144}Ho, /sup 141,142,144/Dy, /sup 140,141,142,144/Tb, /sup 140-142/Gd, and /sup 140-142/Eu, produced by ^{92}Mo(H.I.,xpyn) reactions at the Berkeley SuperHILAC, and studied with the OASIS on-line mass separator facility. Half-lives, delayed proton branching ratios, γ-ray energies and intensities, partial decay schemes and several J/sup π/ assignments are presented. Level systematics of the even mass Nd and Sm isotopes and of the nu h/sub 11/2/ - nu s/sub 1/2/ isomers for N = 77 are discussed.

10214 **New limits on the double beta decay half-lives of /sup 94/Zr, /sup 96/Zr, /sup 116/Cd and /sup 124/Sn.** Norman, E.B.; Meekhof, D.M. (Lawrence Berkeley Lab., CA, USA). *Physics Letters [Section] B;* 195: No. 2, 126-129(3 Sep 1987). Contract AC03-76SF00098.

Searches have been made for the double beta decays of /sup 94,96/Zr, /sup 116/Cd, and /sup 124/Sn to excited states in their daughter nuclei. No evidence of any of these decays was found, and lower limits on the half-lives against such decays have been established to be 10/sup 18/-10/sup 19/ yr. In addition, the single beta decay half-life of /sup 96/Zr has been established to be ≥ 1.7x10/sup 18/ yr.

10215 **Accurate determination of the parameters of the 292.4-eV resonance of ^{91}Zr and the 301.1-eV resonance of ^{96}Zr.** Salah, M.M.; Harvey, J.A.; Hill, N.W.; Hussein, A.Z.; Perey, F.G. (Oak Ridge National Lab., TN, USA). *Radiation Effects;* 93: No. 1-4, 257-260(1986). (CONF-850507—). Contract AC05-84OR21400.

From International conference on nuclear data for basic and applied science; Santa Fe, NM, USA (13 May 1985).

High-resolution transmission measurements of zirconium metal samples have been carried out at ORELA using the 80-m flight path and an improved ^{6}Li-glass scintillation neutron detector. Four different thicknesses of the pure zirconium metal and one sample of zircalloy were used in four separate experiments. The transmission data for these samples were measured at room temperature, and one sample was cooled to liquid nitrogen temperature. These data were analyzed using the multilevel R-matrix computer code SAMMY. The resonance parameters obtained for the 292.4-eV resonance of ^{91}Zr and the 301.1-eV resonance in ^{96}Zr are given.

10216 **Independent isomer yield ration of ^{90}Rb.** Reeder, P.L.; Warner, R.A.; Ford, G.P.; Willmes, H. (Pacific Northwest Lab., Richland, WA, USA; Los Alamos National Lab., NM, USA; Idaho Univ., Moscow, USA). *Radiation Effects;* 94: No. 1-4, 93-96(1986). (CONF-850507—).

From International conference on nuclear data for basic and applied science; Santa Fe, NM, USA (13 May 1985).

The independent isomer yield ratio for ^{90}Rb from thermal neutron fission of ^{235}U has been measured by use of a new technique involving a pulsed reactor and an on-line mass spectrometer facility. The observed isomer yield ratio of 8.7 +- 1.0 is one of the largest ratios measured for a low energy fission process. However, a statistical model analysis shows that the average angular momentum (<J> = 4.5) deduced from this isomer yield ratio is consistent with average angular momentum for other products from low energy fission.

6518 Nuclear Properties And Reactions, A=150-189, Experimental

10217 **(DOE/ER/40048—199-L7) The nucleosynthesis of ^{180}Ta.** Kellogg, S.E. (Washington Univ., Seattle (USA)). 12 Jun 1987. Contract AC06-81ER40048. 238p. NTIS, PC A11/MF A01; 1; GPO Dep. Order Number DE88003361/JAW.

It has been proposed that the abundance of nature's rarest isotope, ^{180}Ta, could be quantitatively accounted for in the standard stellar slow (s) and/or rapid (r) neutron-capture processes through the existence of small, previously unmeasured β-branches which drain and feed the population of the t/sub 1/2/ = 5.5 hour isomer of ^{180}Hf. We have conducted a series of experiments designed to measure these small β-branches. We have: measured the direct (isomer-to-isomer) 214-keV-endpoint β branch from ^{180}Hf/sup m/ to ^{180}Ta/sup m/ to be f/sub β/ = 0.30 +- 0.07 +- 0.07%, observed a new γ ray in the decay of ^{180}Hf/sup m/ which indicated a small β-branch of 0.023% to an excited state in ^{180}Ta, established a stringent limit of 0.023% on the fraction f/sub m/ of ^{180}Lu decays which populate ^{180}Hf/sup m/, sought to identify a possible high-spin, short-lived isomer of ^{180}Lu, and established upper limits on its possible half-life, established limits on the ^{180}Ta/sup m/ photodeexcitation cross-section via resonant and nonresonant processes, and calculated upper-limits on the life-time of ^{180}Ta/sup m/ in a stellar environment. Taken together, this body of work makes it unlikely that the previous proposal can account for the observed solar-system abundance of ^{180}Ta. Other possible production schemes are reviewed and directions for further research are suggested. 97 refs., 53 figs., 14 tabs.

10218 **(INS—635) Anomalous electron intensity ratio of the E0 internal conversion in the transitions of /sup 154/GD.** Sakai, M.; Fujita, Y.; Imamura, M.; Omata, K.; Miyatake, K.; Nomura, T.; Ohya, S.; Chojnacki, S. (Tokyo Univ., Tanashi (Japan). Inst. for Nuclear Study). Jun 1987. 27p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88751049/JAW.

Relative probabilities of the E0 internal conversion for the K-, L-, M- and N+O-shells in the transitions of /sup 154/Gd have been studied in detail with use of special electron measuring techniques. They were compared with the theoretically predicted values. It turned out that the internal conversion is successively hindered from the outer to the inner shells on the assumption that the conversion for the outer shells is normal.

10219 **Particle-hole states at high spin in /sup 150/Dy.** Deleplanque, M.A.; Bacelar, J.C.; Beck, E.M.; Diamond, R.M.; Stephens, F.S.; Draper, J.E.; Doessing, T.; Neergard, K. (Lawrence Berkeley Lab., CA, USA. Nuclear Science Div.; California Univ., Berkeley, USA). *Physics Letters [Section] B;* **195**: No. 1, 17-21(27 Aug 1987). Contract AC03-76SF00098.

The level scheme of the nucleus /sup 150/Dy up to spin around 40 was obtained using the reaction /sup 114/Cd(/sup 40/Ar,4n). Above spins 20 to 22 - the highest obtainable from the valence nucleons - the breaking of the /sup 146/Gd proton and neutron cores occurs in separate parallel cascades.

6519 Nuclear Properties And Reactions, A=190-219, Experimental

10220 **(CONF-8709200—1) Gamma decay of isoscalar and isovector giant resonances following heavy-ion inelastic scattering.** Beene, J.R.; Varner, R.L.; Bertrand, F.E. (Oak Ridge National Lab., TN (USA)). 1987. Contract AC05-84OR21400. 14p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88002801/JAW.

From 1. topical meeting on giant resonance excitation in heavy-ion collisions; Legnaro, Italy (21 Sep 1987).

Results from studies of gamma decay of giant resonances in ^{208}Pb and ^{90}Zr following inelastic excitation by 22 and 84 MeV/nucleon ^{17}O ions are presented. Data on ground state decay of isoscalar giant quadrupole and isovector giant dipole resonances are presented and compared with calculations. Decays from resonances to low lying excited states are also discussed. Preliminary results from an attempt to isolate the isovector quadrupole resonance in ^{208}Pb using its gamma decay are presented.

10221 **(GSI—87-47-Prepr.) Transverse energy production in high energy nuclear collisions and the equation of state of nuclear matter.** Doss, K.G.R.; Gustafsson, H.A.; Gutbrod, H.H.; Kolb, B.; Ludewigt, B.; Poskanzer, A.M.; Ritter, H.G.; Schmidt, H.R.; Kampert, K.H.; Loehner, H. (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.); Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.); Muenster Univ. (Germany, F.R.). Inst. fuer Kernphysik). Aug 1987. 14p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88751010/JAW.

In nuclear collisions of AU+Au, Nb+Nb and Ca+Ca at bombarding energies between 150 and 800 MeV per nucleon transverse energy and transverse momenta of light particles are studied event by event at θ = 90/sup 0/ in the center of mass system. At all energies a rise of the mean transverse energy per nucleon is observed with increasing charged particle multiplicity. Particularly large values of E/sub perpendicular/ /sub to/ have been found for /sup 3/He-fragments. The hydrodynamical picture is discussed for a possible separation of the collective flow and the thermal parts of the E/sub perpendicular/ /sub to/-spectrum. From this, evidence for a rather stiff equation of state is found.

10222 (INIS-mf—11052, pp vp) **Anisotropic α-particle emission measured with nuclear orientation on line.** Wouters, J.; Vandeplassche, D.; van Walle, E.; Severijns, N.; Vanneste, L. (Louvain Univ., Belgium. Inst. for Nuclear- and Radiationphysics). 1985. NTIS (US Sales Only), PC A19/MF A01. Order Number DE88700667/JAW. (CONF-8509430—).

From International summer school on hyperfine interactions and international study meeting: physics with oriented nuclei; Bechyne, Czechoslovakia (2 Sep 1985).

10223 (INIS-mf—11054, pp 75) **Measurement of the electric polarizability of the neutron.** Schmiedmayer, J.; Rauch, H.; Riehs, P. (Technische Univ., Vienna, Austria). Sep 1987. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88700772/JAW. (CONF-8709196—).

From Annual convention fo the Austrian Physical Society; Vienna, Austria (21 Sep 1987).

10224 (INS—632) **On the mysterious electron peak in e/sup +/ + Th interactions.** Sakai, M.; Fujita, Y.; Imamura, M.; Omata, K.; Ohya, S.; Miura, T. (Tokyo Univ., Tanashi (Japan). Inst. for Nuclear Study). May 1987. 11p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88751046/JAW.

The thorium target was irradiated by positrons from a /sup 118/Te-/sup 118/Sb beta-plus source and electrons emitted from the target were measured by means of an electron spectrometer and a counter telescope consisting of two position sensitive counters. We have observed excess electrons located at 328.6 +- 0.3 keV in the spectrogram. The kinematic energy and the intrinsic FWHM of the electron line were deduced to be 333 +- 1 keV and 3.7 +- 0.3 keV, respectively and the cross section was estimated as 120 +- 40 mb. If we assume that the electrons result from the decay of an anomalous particle emitting an electron-positron pair with the same energy, its mass is to be 1688 +- 2 keV.

10225 **(IPNO-DRE—87-10) High excitation inelastic scattering induced by intermediate energy /sup 40/Ar beams.** Frascaria, N.; Blumenfeld, Y.; Chomaz, P.; Garron, J.P.; Jacmart, J.C.; Roynette, J.C.; Suomijarvi, T.; Mittig, W. (Paris-11 Univ., 91 - Orsay, France. Inst. de Physique Nucleaire; GANIL, 14 - Caen, France). (Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire). 1987. 60p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE88751741/JAW.

The inelastic channels of the /sup 40/Ar + /sup 40/Ca, /sup 90/Zn, /sup 120/Sn and /sup 208/Pb reactions at 44 MeV/nucleon and the /sup 40/Ar + /sup 90/Zr reaction at 33 MeV/nucleon were measured with a time of flight spectrometer in the vicinity of the respective grazing angles. In addition to the well known giant quadrupole resonance which is strongly excited, structures at higher excitation energies are observed in all the studied reactions. The existence and regular spacing of these structures are quantitatively confirmed by auto-correlation, cross correlation and Fourier analyses. The contributions to the spectra of transfer-evaporation reactions are calculated by Monte-Carlo methods and are shown to reproduce the measured backgrounds. The excitation energies of the bumps are then shown to vary smoothly with target mass A as A/sup -1/3/. Interpretations of this phenomenon involving giant resonance and multiphonon excitations and multi-transfer reactions are discussed.

10226 **(IPNO-DRE—87-22) Search for high excitation energy structures in /sup 90/Zr and /sup 208/Pb, via /sup 20/Ne inelastic scattering.** Fortier, S.; Gales, S.; Austin, S.M.; Benenson, W.; Crawley, G.M.; Djalali, C.; Lee, J.H.; Plicht, J. van der; Winfield, J.S. (Paris-11 Univ., 91 - Orsay, France. Institut de Physique Nucleaire; Michigan State Univ., East Lansing, USA). (Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire). 1987. 23p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88751623/JAW.

The inelastic of /sup 20/Ne on /sup 90/Zr and /sup 208/Pb has been studied at 500 and 600 MeV incident energies. High statistics spectra were measured at the grazing angle. For each target, spectra at the two incident energies were compared by means of cross correlation analysis. Structures were observed in the inelastic spectra, but they appeared at different excitation energies at the two beam energies and therefore cannot be identified with high-excitation energy states of the target nuclei in contradiction to the results of previous experiments. Rather they arise from the decay of discrete unbound states in the projectile-like nuclei which were excited by a one-nucleon-transfer reaction. In particular, the structures observed in the transfer-evaporation continuum of the /sup 20/Ne + /sup 208/Pb spectra appear to be mainly due to neutron emission from known discrete unbound states in /sup 21/Ne. A relatively low upper limit is given for the production cross section of multiphonon states in these systems.

6520 Nuclear Properties And Reactions, A=220 And Above, Experimental

10227 **(AERE-R—12075) ^{238}U photonuclear studies with 5-10 MeV photons.** Hawkes, N.P. (UKAEA Atomic Energy Research Establishment, Harwell. Nuclear Physics Div.; Birmingham Univ. (UK). Dept. of Physics). Feb 1986. 127p. NTIS (US Sales Only), PC A07/MF A01. Order Number DE88750705/JAW.

The ^{238}U photofission and photoneutron cross sections, and the mean number -ν of prompt neutrons per fission, have been measured between 5 and 10 MeV. The experiment was carried out using bremsstrahlung from the electron linear accelerator HELIOS at Harwell. Neutrons from (γ,f) and (γ,n) reactions on ^{238}U were detected, and neutron multiplicity distributions recorded. Photoneutron events were separated from photofission events by means of their different multiplicities.

10228 **(INDC(NDS)—194) Cf-252 spontaneous fission neutron spectrum in the 5-20 MeV energy range.** Maerten, H.; Richter, R.; Seeliger, D.; Fromm, W.D.; Boettger, R.; Klein, H. (International Atomic Energy Agency, Vienna (Austria). International Nuclear Data Committee). Jan 1987. 20p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88700407/JAW.

The /sup 252/Cf neutron spectrum has been measured at high energies with a miniature ionization chamber and two different NE213 neutron detectors. The γ-ray background and the main cosmic background were suppressed by applying an efficient pulse shape n/(γ,μ) discrimination. On the basis of the two-dimensional spectroscopy of neutron time-of-flight and scintillation pulse height, the sliding bias method has been used to minimize experimental uncertainties. The experimental data corrected for several systematic influences confirm earlier results which show a trend similar to the NBS evaluation. However, the final spectra obtained for both neutron detectors exhibit negative deviations (up to -10%) from the NBS curve in the 6-12 MeV range. Finally, the experimental results of this work are compared with various statistical-model approaches to the /sup 252/Cf(sf) neutron spectrum. 16 refs, 16 figs, 3 tabs.

10229 (INIS-SU—425, pp 45-49) **Preliminary results on the study of /sup 259/Md spontaneous fission parameters.** Sokol, E.A.; Zejnalov, Sh.S.; Sharo, Sh. 1985. (In Russian). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88780037/JAW. (JINR-N—19-86).

In JINR rapid communications. Collection.

The results of measuring the parameters of prompt neutron and γ-ray multiplicity distribution (ν, σ/sub ν//sup 2/, Γ/sub 2/) and of γ-quanta mean energy at /sup 259/Md spontaneous fission are presented. /sup 259/Md isotopes were obtained in the /sup 248/Cm (/sup 18/O, α3n) /sup 102/259 -> /sup 259/Md reaction on the extracted heavy ion beam of the U-300 accelerator (LNR, JINR).

10230 **(IPNO-T—87-02) Production and desexcitation of hot nuclei in /sup 40/Ar + /sup 238/U collisions at 27 MeV/u.** Jacquet, D. (Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire). Jan 1987. 117p. (In French). NTIS (US Sales Only), PC A06/MF A01. Order Number DE88751744/JAW.

The selection of hot nuclei can be achieved through the folding angle of the coincident fission fragments. At this bombarding energy a distinct fusion component shows up in the folding angle correlation function corresponding to the most central collisions. The mass of the fission fragments decreases with increasing linear momentum transfer; the energy dissipated into the target nucleus is proportional to the momentum transfer. The mass distribution full width at half maximum increases with dissipated energy and this can be understood as the result of thermal fluctuations. The light charged particles detected in coincidence with the fission fragments exhibit, at least backwards, the characteristic behaviour of evaporative particles from a thermally equilibrated source. The fused nucleus is revealed as the dominant emitter. The observed energy spectra can be reproduced in a Monte Carlo type simulation assuming that about 80% of the particles arise from the fused nuclei and only 20 % from the fully accelerated fission fragments. A detailed analysis of the shape of the spectra allows to precise the average characteristics of the emitter: it is quite deformed has a very broad spin distribution and a temperature from 4 to 5 MeV. All these characteristics are consistently deduced in semi-classical dynamical calculations based on the Landau-Vlasov equation. The pre-fission particle emission probabilities are shown to be much larger than would predict a purely statistical model for such heavy and hot nuclei. Such a behaviour can only be understood if the dynamics of the collision is taken into account.

10231 **Fission channel analysis for ^{233}Th(n,f).** Becker, J.A.; Bauer, R.W. (Lawrence Livermore National Lab., CA, USA). *Radiation Effects;* 93: No. 1-4, 13-16(1986). (CONF-850507—).

From International conference on nuclear data for basic and applied science; Santa Fe, NM, USA (13 May 1985).

Angular distributions of fission fragments produced in the ^{233}Th(n,f) reaction have been measured in 40-keV intervals. A simplified reaction model was adopted, and a channel analysis done for 0.72 <= Esub(n) (MeV) <= 4.5 MeV. An anomaly at Esub(n) 2.98 MeV suggests that K remains a good quantum number some 2 MeV above the fission threshold. The percentage contribution to the cross section of K = 3/2 states for incident neutron energies between 1.1 and 1.3 MeV is larger than previously thought.

10232 **Neutron total cross section of ^{240}Pu below 6 eV and the parameters of the 1.056-eV resonance.** Spencer, R.R.; Harvey, J.A.; Hill, N.W.; Weston, L.W. (Oak Ridge National Lab., TN, USA). *Radiation Effects;* 93: No. 1-4, 245-248(1986). (CONF-850507—). Contract AC05-84OR21400.

From International conference on nuclear data for basic and applied science; Santa Fe, NM, USA (13 May 1985).

Measurements of the low-energy neutron transmission of five different ^{240}Pu samples have been made using the Oak Ridge Electron Linear Accelerator (ORELA) pulsed-neutron source and the time-of-flight technique in an attempt to resolve discrepancies between the evaluated low-energy cross section of this nuclide and the observed production of heavier Pu isotopes in light-water reactors (LWRs). Three "thin" samples consisting of Pu metal foils containing 0.726 at. % ^{240}Pu were measured above 0.4 eV in order to derive the parameters of the 1.056-eV resonance, which is responsible for most of the observed 2200-m/s total cross section. Two "thick" samples of 99.97 at. % ^{240}Pu metal were measured from 0.003 eV to about 6 eV to obtain the 2200-m/s cross section and the cross-section shape in the low-energy region. A consistent set of resonance parameters was derived from the above data sets.

10233 **Measurement of the energy dependence of prompt fission neutron emission from ^{233}U, ^{235}U, and ^{239}Pu for E = 0.0005 to 10 MeV relative to emission from spontaneous fission of ^{252}Cf.** Gwin, R.; Spencer, R.R.; Ingle, R.W. (Oak Ridge National Lab., TN, USA). *Radiation Effects;* 93: No. 1-4, 253-256(1986). (CONF-850507—). Contract AC05-84OR21400.

From International conference on nuclear data for basic and applied science; Santa Fe, NM, USA (13 May 1985).

A series of experiments has been performed to measure the dependence on the incident neutron energy of the average number of prompt neutrons emitted per fission, of ^{233}U, ^{235}U, and ^{239}Pu relative to the average number of prompt neutrons emitted in spontaneous fission of ^{252}Cf. The incident energy range was 0.0005 to 10 MeV. A white neutron source was generated by the Oak Ridge Electron Linear Accelerator and the energies of the neutrons incident on the fissile samples were determined by time-of-flight techniques. The fissile sample and the ^{252}Cf standard were contained in a fission chamber surrounded by a large volume liquid scintillator loaded with gadolinium. Fissions were detected by the fission chamber and the neutrons were detected by the scintillator. The results for ^{239}Pu agree over most of the energy range with the results of the evaluation of Manero and Konshin. However, the present results are larger for ^{235}U than those of Manero and Konshin and for ^{233}U the present data yield a different energy dependence in the interval 100 to 600 keV. Final results are displayed.

10234 Status of fast neutron nuclear data for ^{239}Pu. Arthur, E.D. (Los Alamos National Lab., NM, USA). *Radiation Effects;* **93**: No. 1-4, 109-121(1986). (CONF-850507—).

From International conference on nuclear data for basic and applied science; Santa Fe, NM, USA (13 May 1985).

Recent energy-averaged data (fission, total cross section, scattering and upsilon-barsub(p) describing the interaction of fast neutrons with ^{239}Pu are discussed, with emphasis on neutron energies higher than the inelastic scattering threshold. The linkage between such experimental data and new theoretical calculations is described in context of their influence on a new revision to the ENDF/B-V ^{239}Pu evaluation. Results from this new revision are compared with other current ^{239}Pu evaluations. Incorporation of such information pertaining to neutron emission and upsilon-barsub(p) in the new ENDF revision had a profound impact on calculations performed for fast critical assemblies. Such calculational results are presented with emphasis on systematic improvements achieved in eigenvalues and fission ratios.

10235 Analysis of U-238 self-indication experiments. Harris, D.R.; Block, R.C.; Hwang, R.N. (Rensselaer Polytechnic Inst., Troy, NY, USA; Argonne National Lab., IL, USA). *Radiation Effects;* **93**: No. 1-4, 169-172(1986). (CONF-850507—).

From International conference on nuclear data for basic and applied science; Santa Fe, NM, USA (13 May 1985).

Self-indication experiments provide energy-dependent analogues of self-shielded resonance integral measurements and are important in verifying U-238(n,γ) unresolved resonance data for fast reactor design. RPI self-indication measurements for U-238(n,γ) are analyzed and compared with predictions using current fast reactor design methods and data. The analyses emphasize the reevaluation of time-dependent background, the inclusion of multiple scattering corrections, and the analysis of capture tank efficiencies for s-wave and p-wave neutrons. The background and multiple scattering corrections reduce the previously reported self-indication ratios at neutron energies below 10 kev, reducing a discrepancy with calculations in this energy range. Calculated values of SIR exceed measured values at energies above 10 kev. The capture tank efficiency is found to be the same for s-wave and p-wave neutron-induced gammas within calculational uncertainties.

10236 Application of evaluated fission-product delayed-neutron precursor data in reactor kinetics calculations. Perry, R.T.; Brady, M.C.; Wilson, W.B.; England, T.R. (Texas A and M Univ., College Station, USA; Los Alamos National Lab., NM, USA). *Radiation Effects;* **94**: No. 1-4, 43-48(1986). (CONF-850507—).

From International conference on nuclear data for basic and applied science; Santa Fe, NM, USA (13 May 1985).

Evaluated fission-product yield and decay data have been used to describe 105 delayed neutron precursors explicitly in point reactor kinetics calculations. Results calculated for ^{235}U thermal fission show that rod-drop reactivity values obtained from kinetics calculations with 6-group precursor data are considerably higher than those calculated with explicit delayed-neutron precursor data. The calculated kinetics associated with positive reactivity steps are significantly different.

10237 Delayed neutron spectra and intensities from evaluated precursor data. England, T.R.; Brady, M.C.; Wilson, W.B.; Schenter, R.E.; Mann, F.M. (Los Alamos National Lab., NM, USA; Hanford Engineering Development Lab., Richland, WA, USA). *Radiation Effects;* **94**: No. 1-4, 65-68(1986). (CONF-850507—).

From International conference on nuclear data for basic and applied science; Santa Fe, NM, USA (13 May 1985).

Recently evaluated and model estimated precursor data are used with preliminary ENDF/B-VI fission yields to calculate total and time-group - upsilon-bar/sub d/ and spectra.

10238 Gamma-ray line intensities for depleted uranium. Moss, C.E. (Los Alamos National Lab., NM, USA). *Radiation Effects;* **94**: No. 1-4, 81-84(1986). (CONF-850507—).

From International conference on nuclear data for basic and applied science; Santa Fe, NM, USA (13 May 1985).

Measurements of the gamma-ray line intensities from depleted uranium allowed us to determine which of two conflicting previous experiments was correct. For the 1001-keV line a branching ratio of 0.834 +- 0.007 was obtained in good agreement with one of the previous experiments. A table compares our intensities for several lines with those obtained in previous experiments.

6530 Nuclear Theory

REFER ALSO TO CITATION(S) 8444, 9998, 10043, 10071, 10083, 10093, 10108, 10166, 10181, 10365, 10425

10239 (CBPF-NF—001/87) QED description of relativistic Coulomb excitation in heavy ion collisions. Galetti, D.; Kodama, T.; Nemes, M.C. (Instituto de Fisica Teorica, Sao Paulo, Brazil; Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro; Sao Paulo Univ., Brazil. Inst. de Fisica). (Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro). 1987. 36p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88700834/JAW.

A quantum electrodynamical treatment of Coulomb excitation in relativistic heavy ion collisions is presented. It is shown that a subtle interplay between quantum and relativistic kinematical effects induced by the nuclear recoil due to the excitation generates a qualitatively different prediction (in certain kinematical conditions) from the corresponding prediction of conventional theories. The present formalism is applied to the clean fission problem and the results seem to solve the puzzle associated to this process for some time.

10240 (CLM-R—261) User manual for THRES-F code. Giancarli, L.; Gruppelaar, H. (Commission of the European Communities, Abingdon (UK). JET Joint Undertaking). Oct 1985. 33p. H.M. Stationery Office, London, price Pound 5.00.

Experimental cross-section data for neutron-induced reactions in the energy range 0-20 MeV are often incomplete or nonexistent. The code described in the present manual permits the approximate calculation of the cross-sections of all the energetically possible neutron-induced reactions (except radiative capture) coupling the statistical-model theory with systematics formulae and available experimental data. Pointwise and group cross-sections for energies up to 20 MeV can be determined with only Z and A required as description of the target nucleus.

10241 (CONF-870970—20) Oblate-prolate shape competition in Z = 34 to 38 nuclei. Hamilton, J.H.; Ramayya, A.V.; Zhao, X.; Maguire, C.F.; Ma, W.C.; KormickI, J.; Wen, S.; Chaturvedi, L.; Chen, Z.M.; Cormier, T.M. (Vanderbilt Univ., Nashville, TN (USA); Rochester Univ., NY (USA); EG and G Idaho, Inc., Idaho Falls (USA); Florida Univ., Gainesville (USA). Space Astronomy Lab.; Louisiana State Univ., Baton Rouge (USA); UNISOR, Oak Ridge, TN (USA)). Sep 1987. Contract AS05-76ER04935;AS05-76ER05034;AC05-76OR00033. 11p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88002781/JAW.

From 5. international conference on nuclei far from stability; Lake Rosseau, Canada (14 Sep 1987).

Now magic numbers for deformed shapes are established at N and Z of 38 and N of 60. These shell gaps at large deformation ($\beta \approx 0.4$) are magic when the proton and neutron shell gaps reinforce each other. Other shell gaps for 34 and 36 are predicted to be important for oblate deformation. The competition between these oblate and the 38 prolate gaps as well as the 40 spherical shell gap are considered. In ^{71}Se coexistence of oblate ($\beta \approx -0.24$) and large prolate ($\beta \approx 0.4$) shapes are observed. In ^{72}Se the excited prolate band with large deformation which coexists with the near-spherical ground state is found to dominate the yrast spectrum to 28^{+}. The moment of inertia of this band is essentially that of a rigid body. This moment of inertia supports the suggestion that the "super deformation", $\beta \approx 0.4$, being observed in this region may be associated with a collapse of pairing.

10242 (CONF-8708102—9) Surface response model for quasielastic scattering. Esbensen, H. (Argonne National Lab., IL (USA)). 1987. Contract W-31109-ENG-38. 13p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88002976/JAW.

From Pion nucleus physics: future directions and new facilities at LAMPF workshop; Los Alamos, NM, USA (17 Aug 1987).

The description of nucleon-nucleus inelastic scattering in terms of single-scattering has been very successful at intermediate energies. Nuclear structure is the most dominant feature at low excitations and forward scattering, and the Distorted Wave Impulse Approximation (DWIA) has been the most useful technique to extract structure information. The conventional DWIA has also been applied to quasielastic scattering. However, this method is very time-consuming at large scattering angles, since many different excitations of different multipolarities contribute to the inelastic cross section. It has therefore been useful to develop an approximate treatment that contains the main physics of quasielastic scattering. In the following the author will try to establish the connection between the DWIA and the much simpler Surface Response Model. The author will give a short description of the Random Phase Approximation that is used to calculate the nuclear response, and illustrate the spin-isospin dependence of the nucleon-nucleon t-matrix interaction, which is used to generate the excitations of the target nucleus. Finally, some of the applications of the surface response model to (p,p'), (p,n) and (^{3}H,t) reactions are reviewed. 19 refs., 5 figs.

10243 (CRN-PN—87-08) Log f0 and log f1 data tables for energy beta transitions within 10 and 25 MeV and elements of 6 ≦ Z ≦ 38. Dessagne, P.; Miehe, C. (Strasbourg-1 Univ., 67 (France). Centre de Recherches Nucleaires). 1987. 25p. (In French). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88750658/JAW.

The log f values for allowed and first forbidden unique beta + and beta - transitions for elements situated between carbon and strontium have been calculated as a function of transition energy which value is comprised within 0.1 and 25 MeV. For 6 ≦ Z ≦ 38 and for transition energy higher than 10 MeV, the orbital electron capture to beta + emission rate is less than 10/sup -3/. Beyond 10 MeV, the electron capture contribution is negligible.

10244 (DOE/ER/40048—28-N7) Summary of theoretical discussion. Henley, E.M. (Washington Univ., Seattle (USA). Inst. for Nuclear Theory). 1987. Contract AC06-81ER40048. 5p. (CONF-8705208—1). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE87011826/JAW.

From Workshop on parity violations in hadronic systems; Vancouver, UK (28 May 1987).

This paper presents a summary of the discussions held at a conference dealing with the quark model of the nucleus. (JDH)

10245 (GSI—87-42-Prepr.) ATTILA (All Type Target Independent Lund Algorithm) for nuclear collisions at ≃ 200 AGeV. Gyulassy, M. (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.)). Aug 1987. 22p. (CONF-8706233—). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88751008/JAW.

From International conference on intermediate energy nuclear physics; Balatonfured, Hungary (8 Jun 1987).

The Lund string model, Fritiof, is applied in the form of a Monte-Carlo event generator, ATTILA, to nuclear collisions in the 200 AGeV range. We study how uncertainties at the pp level amplify at the AB level and compare preliminary CERN data on multiplicity, transverse energy, and veto energy distributions to this linear extrapolation scheme from pp to AB dynamics.

10246 (GSI—87-48(prepr.)) Collective azimuthal alignment and transverse momentum conservation in relativistic heavy-ion collisions. Bock, R.; Gutbrod, H.H.; Siemiarczuk, T. (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt, Germany, F.R.; Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt, Germany, F.R.; Institute for Nuclear Studies, Warsaw, Poland). (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.); Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.); Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.)). Aug 1987. 9p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88751497/JAW.

It is shown that transverse momentum conservation in the three-source Fai and Randrup statistical model does not explain the collective azimuthal alignment as observed in heavy-ion collisions at Bevelac energies.

10247 (INIS-BR—876) Kinetic description of nuclear photoabsorption process. Ferreira Filho, L.G. (Sao Paulo Univ. (Brazil). Inst. de Fisica). 1986. 50p. (In Portuguese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88700410/JAW.

A phenomenological model for small amplitude nuclear vibrations is presented. The model separates explicitly the collective degree of freedom and considers its interaction with unspecified intrinsic degrees of freedom. The nuclear response function was calculated, including quantum correlation effects up to second order in the coupling potential, and compared with the usual harmonic approximation for the density fluctuation. The coupling between the two systems is treated with a phenomenological ansatz. The parameters are adjusted so as to reproduce the experimental total photoabsorption cross section for two nuclei (/sup 208/ Pb, /sup 238/ U). It is shown that the inclusion of correlations may strongly alter the form of this curve as compared to the usual lorentz curve. In the semiclassical limit the effective dynamics of the collective degree of freedom is shown to obey a Fokker-Planck equation.

10248 (INIS-BR—877) (γ,n) reaction in nuclei of the 12 <= A <= 238 interval in the intermediate energy region (300 MeV-1000MeV). Martins, J.B. (Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro). 1974. 140p. (In Portuguese). NTIS (US Sales Only), PC A07/MF A01. Order Number DE88700411/JAW.

The absolute cross section of the /sup 12/C(γ,n)/sup 11/C, /sup 19/F(γ,n)/sup 18/F, /sup 23/Na(γ,n)/sup 22/Na, /sup 31/P(γ,n)/sup 30/P, /sup 52/Cr(γ,n)/sup 51/Cr, /sup 55/Mn(γ,n)/sup 54/Mn, /sup 59/Co(γ,n)/sup 58/Co, /sup 75/As(γ,n)/sup 74/As, /sup 103/Rh(γn)/sup 102/Rh, /sup 127/I(γ,n)/sup 126/I, /sup 197/Au(γ,n)/sup 196/Au and /sup 238/U(γ,n)/sup 237/U reactions were determined, experimentally, in the energy range from 300 MeV to 1000 MeV, using Bremsstrahlung photons. The measured cross sections were compared with results estimated by Monte Carlo Method applied to intranuclear cascades initiated by photons. A functional dependence between the average value of (γ,n) absolute cross section and the mass number, were established. The (γ,n) absolute cross sections from simple relations, which transparencies of complexe nuclei for mesons and nucleons photo produced were also determined. (M.C.K.).

10249 (INIS-mf—11052, pp vp) Nuclear level mixing resonant spectroscopy: theory and first applications. Scheveneels, G.; Hardeman, F.; Coussement, R. (Louvain Univ., Belgium. Inst. for Nuclear- and Radiationphysics). 1985. NTIS (US Sales Only), PC A19/MF A01. Order Number DE88700667/JAW. (CONF-8509430—).

From International summer school on hyperfine interactions and international study meeting: physics with oriented nuclei; Bechyne, Czechoslovakia (2 Sep 1985).

The concept of nuclear level mixing is described; first, the need for this method is shortly discussed. The method itself is explained by means of a "rotating-frame picture", and a summary of the formalism needed to describe the resonances analytically is given. The characteristics of level mixing resonances is illustrated by means of computer calculations and by experimental results,

both for low temperature and for in-beam nuclear orientation. The possibility for investigating quadrupolar moments of high-spin isomeric states is mentioned.

10250 (INIS-mf—11052, pp vp) **Optical spectroscopy of short-lived isotopes and minute samples.** Bonn, J. (Mainz Univ., Germany, F.R. Inst. fuer Physik). 1985. NTIS (US Sales Only), PC A19/MF A01. Order Number DE88700667/JAW. (CONF-8509430—).

From International summer school on hyperfine interactions and international study meeting: physics with oriented nuclei; Bechyne, Czechoslovakia (2 Sep 1985).

10251 (INIS-mf—11052, pp vp) **Basic ideas of the interacting boson model and its relation to the shell model.** Evans, J.A. (Sussex Univ., Brighton, UK). 1985. NTIS (US Sales Only), PC A19/MF A01. Order Number DE88700667/JAW. (CONF-8509430—).

From International summer school on hyperfine interactions and international study meeting: physics with oriented nuclei; Bechyne, Czechoslovakia (2 Sep 1985).

The basic ideas are formulated of the interacting boson model. Symmetry groups of the model are presented. Also discussed is its relation to the geometrical model and to the shell model. (Z.J.).

10252 (INIS-mf—11052, pp vp) **Parity nonconservation and the structure of energy levels of nuclei.** Feoktistov, A.I. (AN Ukrainskoj SSR, Kiev. Inst. Yadernykh Issledovanij). 1985. (In Russian). NTIS (US Sales Only), PC A19/MF A01. Order Number DE88700667/JAW. (CONF-8509430—).

From International summer school on hyperfine interactions and international study meeting: physics with oriented nuclei; Bechyne, Czechoslovakia (2 Sep 1985).

From experimental data obtained at low excitation energies of nuclei of /sup 19/F, /sup 180/Hf, /sup 184/W, the value was determined of the matrix element of the Hamiltonian ?<H/sub rhov/>? with parity nonconservation. For the gamma transition 110 keV->0 keV (E1+M1-bar) in the /sup 19/F nucleus the value of ?<H/sub rhov/>? was found to be 0.43+-0.13 eV, for the gamma transition 1142 keV->641 keV (M2+E3+E2-bar) in the /sup 180/Hf nucleus it was (1.1+-0.2)x10/sup -6/ eV, and for the gamma transition 1285 keV->364 keV (E1+M2+E3+E2-bar) in the /sup 184/W nucleus the value was (1.6+-0.5)x10/sup -3/ eV. (Z.J.).

10253 (INIS-mf—11052, pp vp) **Neutron-proton interacting boson model (IBA-2).** Lipas, P.O. (Jyvaeskylae Univ., Finland). 1985. NTIS (US Sales Only), PC A19/MF A01. Order Number DE88700667/JAW. (CONF-8509430—).

From International summer school on hyperfine interactions and international study meeting: physics with oriented nuclei; Bechyne, Czechoslovakia (2 Sep 1985).

An elementary account is given of the neutron-proton interacting boson model (IBA-2). Emphasis is on the phenomenological and qualitative aspects of the model, particularly in relation to IBA-1. Young tableaux are introduced for classification of wave function symmetries. The generalized Bose principle is introduced for the construction of complete IBA-2 wave functions. Proton-neutron symmetry with associated F spin and Majorana force is studied in terms of simple examples [U(5) limit and small boson numbers?. E2 and M1 matrix elements and selection rules are worked out in detail. The numerical application is discussed.

10254 (INIS-mf—11052, pp vp) **Optical orientation of nuclei.** Zareckij, D.F. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii). 1985. (In Russian). NTIS (US Sales Only), PC A19/MF A01. Order Number DE88700667/JAW. (CONF-8509430—).

From International summer school on hyperfine interactions and international study meeting: physics with oriented nuclei; Bechyne, Czechoslovakia (2 Sep 1985).

The theory is presented of optical orientation of atomic nuclei by means of lasers. The principle of the method is described and the conditions are discussed of the nuclear orientation production as are depolarization effects and the effect of Doppler broadening on optical orientation. (Z.J.).

10255 (INIS-mf—11052, pp vp) **Nuclear magnetic properties by the IBA.** Lipas, P.O. (Jyvaeskylae Univ., Finland). 1985. NTIS (US Sales Only), PC A19/MF A01. Order Number DE88700667/JAW. (CONF-8509430—).

From International summer school on hyperfine interactions and international study meeting: physics with oriented nuclei; Bechyne, Czechoslovakia (2 Sep 1985).

10256 (INIS-mf—11052, pp vp) **Induced tensor term in the weak nucleon axial currents studied by use of the oriented nuclei.** Minamisono, T.; Matsuta, K.; Nojiri, Y.; Takeyama, K. (Osaka Univ., Japan). 1985. NTIS (US Sales Only), PC A19/MF A01. Order Number DE88700667/JAW. (CONF-8509430—).

From International summer school on hyperfine interactions and international study meeting: physics with oriented nuclei; Bechyne, Czechoslovakia (2 Sep 1985).

Precise alignment-correlation coefficients as a function of β-ray energy in /sup 12/B and /sup 12/N decays were determined. A new upper limit is given to the induced tensor current. Also discussed is the weak magnetism term as well as the time component of the main axial current.

10257 (INIS-mf—11054, pp 70) **Pseudomagnetic nuclear model.** Eder, G. (Technische Univ., Vienna, Austria). Sep 1987. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88700772/JAW. (CONF-8709196—).

From Annual convention fo the Austrian Physical Society; Vienna, Austria (21 Sep 1987).

10258 (INIS-mf—11054, pp 71) **Occupation number of the 3s1/2 proton shell in lead 208.** Grabmayr, P.; Wagner, G.; Clement, H.; Klein, S.; Reiner, K.; Roehm, H. (Tuebingen Univ., Germany, F.R. Physikalisches Inst.). Sep 1987. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88700772/JAW. (CONF-8709196—).

From Annual convention fo the Austrian Physical Society; Vienna, Austria (21 Sep 1987).

10259 (INIS-mf—11054, pp 74) **Global Gauss-shaped one-particle potential.** Meczes, A.; Eder, G.; Leeb, H. (Technische Univ., Vienna, Austria). Sep 1987. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88700772/JAW. (CONF-8709196—).

From Annual convention fo the Austrian Physical Society; Vienna, Austria (21 Sep 1987).

10260 (INIS-mf—11054, pp 69) **Deuteron wave functions and elastic electron-deuteron scattering.** Certov, A.; Mathelitsch, L.; Moravcsik, M. (Graz Univ., Austria. Inst. fuer Theoretische Physik). Sep 1987. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88700772/JAW. (CONF-8709196—).

From Annual convention fo the Austrian Physical Society; Vienna, Austria (21 Sep 1987).

10261 (INIS-mf—11054, pp 73) **Spectroscopic transition strengths in high-dimensional model spaces.** Leitner, W.; Muether, H.; Taigel, T. (Tuebingen Univ., Germany, F.R. Inst. fuer Theoretische Physik). Sep 1987. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88700772/JAW. (CONF-8709196—).

From Annual convention fo the Austrian Physical Society; Vienna, Austria (21 Sep 1987).

10262 (INIS-mf—11054, pp 76) **Faddeev calculations for low-energy p-d scattering.** Berthold, G.; Stadler, A.; Zankel, H. (Graz Univ., Austria. Inst. fuer Theoretische Physik). Sep 1987. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88700772/JAW. (CONF-8709196—).

From Annual convention fo the Austrian Physical Society; Vienna, Austria (21 Sep 1987).

10263 (INIS-mf—11054, pp 77) **Exotic radioactivity of thorium- and radium isotopes.** Weselka, D.; Copty, A.; Chalupka, A.; Hille, P.; Vonach, H. (Vienna Univ., Austria. Inst. fuer Radiumforschung und Kernphysik). Sep 1987. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88700772/JAW. (CONF-8709196—).

From Annual convention fo the Austrian Physical Society; Vienna, Austria (21 Sep 1987).

10264 (IPNO-DRE—87-06) **Narrow dibaryons: experimental confirmations and theoretical incertitudes.** Tatischeff, B. (Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire). 1987. 18p. (In French). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88751619/JAW.

Current situation is presented about narrow isovectorial, non-strange, dibaryon resonances. First positive results have often been criticized for their poor statistics. It is shown in this paper that this time is over and that dibaryon existence cannot any more be discussed. Different assumptions have been made to explain the observed results; these results are reviewed; assumptions are tentatively refuted so as not to have to recall them later during a discussion on recent theories.

10265 (IPNO-TH—86-70) **Are multiphonons excited in heavy ion collisions.** Chomaz, P. (Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire). 1986. 9p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88751748/JAW.

We present new results on high energy structures in heavy ion collisions obtained at GANIL. We discuss an interpretation of these experimental results in terms of multiphonon excitations built from 2 h/2πw giant resonances and we compare our calculation with various other collective excitation calculations.

10266 (IPNO-TH—86-86) **Interference effects in heavy-ion collisions elastic-transfer in-phase rule.** da Silveira, R.; Leclercq-Willain, C. (Paris-11 Univ., 91-Orsay, France. Inst. de Physique Nucleaire; Universite Libre, Brussels, Belgium). (Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire). 1986. 13p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88751624/JAW.

We show from the comparison of the experimental angular distributions of one-neutron transfer reactions with that of the elastic scattering that a specific phase rule emerges. This elastic-transfer phase rule states that the oscillations in the neutron transfer cross-section should be in phase with those of the elastic cross-section. This feature is independent of the angular momentum transferred. Furthermore, we show how these results can be understood through semi-classical arguments.

10267 (IPNO-TH—87-18) **Consistent derivation of the real and imaginary parts of the heavy ion potential below and above the Coulomb barrier.** Vinh Mau, N. (Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire). Mar 1987. 21p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88751626/JAW.

In a model including approximately a large set of non elastic channels, the real and imaginary potentials are consistently derived. The anomaly of the real potential which sharply increases in the vicinity of the Coulomb barrier where the imaginary potential is strongly reduced is studied in /sup 16/O+/sup 40/Ca and /sup 16/O+/sup 208/Pb systems. The results on the imaginary potential are discussed and compared to our previous calculation.

10268 (IPNO-TH—87-27) **Heavy-ion inelastic scattering in a multiphonon excitation model.** Catara, F.; Vitturi, A.; Chomaz, P. (INFN, Catania, Italy; INFN, Padova, Italy). (Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire). 1987. 24p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88751627/JAW.

The double differential inelastic scattering cross section around the grazing angle for the /sup 40/Ca+/sup 40/Ca system is evaluated within a model where the excited states are described in terms of multiphonons. The phonon states described in the RPA are excited through the action of the mean field associated with the other colliding nucleus. The excitation amplitudes are evaluated by integrating the equations of motion along classical trajectories. The feedback on the trajectory of the multiphonon excitation is taken into account. The cross section is then evaluated within a semi-quantal approximation by summing the scattering amplitudes corresponding to the various classical trajectories. The results indicate that, within the model, states corresponding to the single and double excitation of the giant quadrupole mode are appreciably excited, giving rise to bumps in the cross section. Some qualitative comparisons with the experimental data are shown.

10269 (ISN—87-46) **Study on the fusion reaction /sup 139/La + /sup 12/C at 50 MeV/u with the VUU equation.** Pi, M.; Schuck, P.; Suraud, E.; Gregoire, C.; Remaud, B.; Sebille, F. (Grenoble-1 Univ., 38 (France). Inst. des Sciences Nucleaires). Mar 1987. 5p. (CONF-8703153—). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88750669/JAW.

From International workshop on semi-classical and phase-space approaches to the dynamics of the nucleus; Aussois, France (16 Mar 1987).

Recently Bowman et al. found that in the reaction /sup 139/La + /sup 12/C at 50 MeV/u a compound nucleus is formed. We simulate this reaction with a numerical solution of the VUU equation and indeed find that for a central collision the system fuses and equilibrates after 90 fm/c.

10270 (ISN—87-50) **Semi-classical description of giant resonances at finite temperature.** Suraud, E.; Barranco, M.; Treiner, J. (Grenoble-1 Univ., 38 (France). Inst. des Sciences Nucleaires). Mar 1987. 9p. (CONF-8703153—). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88750670/JAW.

From International workshop on semi-classical and phase-space approaches to the dynamics of the nucleus; Aussois, France (16 Mar 1987).

We present a study of the temperature dependence of the energies of isoscalar giant resonances within a semi-classical model, in the framework of the subtraction procedure of Bonche, Levit and Vautherin. This prescription allows a consistent treatment of continuum effects, which play, as we show in detail, a crucial role in the description of excited collective motions. Special attention is paid to the monopole resonance for which 3 moments of the strength function have been calculated. We find a weak temperature dependence of the studied resonance energies (l=,2,3,4).

10271 (ISN—87-60) **Surface behaviour of the phase-space distribution for heavy nuclei.** Durand, M. (Grenoble-1 Univ., 38 (France). Inst. des Sciences Nucleaires). Jun 1987. 5p. (CONF-8706233—). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88750672/JAW.

From International conference on intermediate energy nuclear physics; Balatonfured, Hungary (8 Jun 1987).

A part of the oscillations of the phase space distribution function is shown to be a surface effect. A series expansion for this function is given, which takes partially into account this oscillatory structure.

10272 (ITEF—107-1986) Calculation of radionuclide production a quasideal cycle. Nemirovskaya, S.A.; Rudik, A.P. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1986. 16p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88700450/JAW.

A program for calculating radionuclide production in a quasi-ideal irradiation cycle and the results of calculation of californium production resulting from irradiation of Pu-239 are presented. The program permits to optimize nuclide irradiation in the quasi-ideal cycle, i.e. when isotopes of each element are irradiated independently. The program is in operation. The calculated data on production of transuranium isotopes from irradiation of Pu-239 have shown that the basic optimization effect for the first isotopes of the element is caused by continuous extraction of target nuclide, and for /sup 251/Cf and /sup 252/Cf - by inexpediency of irradiation of /sup 249/Bk and californium isotopes at early process stages. 7 refs.; 4 tabs.

10273 (JINR—E-4-86-717) Spinor symmetry in odd Xe and Ba nuclei. Michajlova, M.M. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1986. 6p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88700490/JAW.

The possibility of interpreting the nucle of /sup 131,/ /sup 133/Xe and /sup 135/Ba by classifying their excited states using the quantum numbers, characteristic for the "spinor" symmetry of a mixed system of bosons and fermions, is tested. The level-energies and E2-transition probabilities are calculated in qualitatie agreement with the experiment. 12 refs.; 1 fig.; 2 tabs.

10274 (JINR—E-4-86-755) Towards unified description of elastic and inelastic scattering of nucleons and composite particles. Dao Tien Khoa; Knyaz'kov, O.M. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1986. 22p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88700491/JAW.

A unified semimicroscopic approach to the description of nucleon- and composite nuclear particle scattering has been proposed. The optical potentials and inelastic form factors are obtained in a closed form with taking into account the Pauli principle in the local density approximation. 22 refs.

10275 (JINR—E-7-86-558) On the possibility of post-equilibrium polar particle emission in heavy-ion induced fusion-fission reactions. Maedler, P.; Milek, B.; Reif, R. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1986. 9p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88700493/JAW.

The search for fast polar post-equilibrium particles in heavy-ion induced fission at incident energies slightly above the Coulomb barrier is carried out. A possible schematic experimental setup and two independent methods to discriminate pre- and post-equilibrium components are discussed. Some model estimates seem to indicate that the effect might be enhanced in heavy-ion induced fission compared to spontaneous fission. 16 refs.; 2 figs.; 1 tab.

10276 (JINR—E-7-86-701) Nuclear molecular dynamics approach to the nucleus-nucleus potentials. Betak, E. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1986. 8p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88700494/JAW.

Nuclear molecular dynamics approach with several sets of the effective nucleon-nucleon potentials is used in order to construct dynamical nucleus-nucleus potentials. The method is illustrated on the case of the /sup 40/Ca+/sup 40/Ca system. The resulting nucleus-nucleus potential varies with the incident energy of interacting nuclei for a fixed nucleon-nucleon potential; the interaction range is a decreasing function of energy. 23 refs.; 4 figs.; 1 tab.

10277 (JINR-R—2-86-802) Simulation of nuclear collisions at high energies in the frames of quark-gluon string model. Amelin, N.S. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Computing Techniques and Automation). 1986. 14p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88700914/JAW.

COLLI-program complex for computer simulation of soft hadronic, hadrom-nucleus, nucleus-nucleus collisions is applied for calculation of different characteristics of the nucleus-nucleus interaction products at high energies. The quark-gluon string model is chosen as a physical model. In the inelastic nucleus-nucleus interactions the strings with quarks at their ends were first created, which decayed later into hadron chains. The Monte Carlo method is used for generating the exclusive events being the result of nucleus-nucleus collisions. In particular, the collisions of the oxygen nuclei with a series of target-nuclei within the 50-500 GeV/n energy range are considered. 15 refs.; 13 figs.

10278 (JINR-R—2-86-803) About the production of fast charged particles in cascade type model. Amelin, N.S. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Computing Techniques and Automation). 1986. 15p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88700915/JAW.

COLLI-program complex for computer simulation of soft hadronic, hadron-nucleus, nucleus-nucleus collisions is used to investigate the fast charged particle yield from the proton-nucleus interactions at high energies. Different models of cascade type are used as physical models of proton-nucleus interactions. The Monte Carlo method is applied for generation of the collision result events. 18 refs.; 9 figs.

10279 (UCID—21126) Introduction and guide to LLNL's relativistic 3-D nuclear hydrodynamics code. Zingman, J.A.; McAbee, T.L.; Alonso, C.T.; Wilson, J.R. (Lawrence Livermore National Lab., CA (USA)). Nov 1987. Contract W-7405-ENG-48. 35p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88003708/JAW.

We have constructed a relativistic hydrodynamic model to investigate Bevalac and higher energy, heavy-ion collisions. The basis of the model is a finite-difference solution to covariant hydrodynamics, which will be described in the rest of this paper. This paper also contains: a brief review of the equations and numerical methods we have employed in the solution to the hydrodynamic equations, a detailed description of several of the most important subroutines, and a numerical test on the code. 30 refs., 8 figs., 1 tab.

10280 Structure functions and correlations in nuclei. Schiavilla, R.; Lewart, D.S.; Pandharipande, V.R.; Pieper, S.C.; Wiringa, R.B.; Fantoni, S. (Illinois Univ., Urbana, USA. Dept. of Physics; Argonne National Lab., IL, USA. Physics Div.; Pisa Univ., Italy. Dipt. di Fisica; Istituto Nazionale di Fisica Nucleare, Pisa, Italy). *Nuclear Physics [Section] A;* **473**: No. 2, 267-289(26 Oct 1987).

The static longitudinal structure function S/sub l/(k) and the static structure function S(k) of /sup 3/H, /sup 3/He and /sup 4/He nuclei and nuclear matter are calculated using realistic wave functions obtained from Faddeev and variational calculations. In order to study the variation of the structure function with the number of particles in the system we also calculate S(k) of atomic helium liquid drops containing 4, 8, 20, 40, 70, 168 and 240 atoms. Monte Carlo integration is used to calculate the structure functions of finite systems, while those of nuclear matter are calculated with chain summation methods. The behaivior of S(k) and S/sub l/(k) at small values of k is discussed. We find that the recent Saclay data on S/sub l/(k) of the /sup 3/He nucleus are in agreement with theory. Though the data indicate the the existence of correlations between the two protons in the /sup 3/He nucleus, they are not accurate enough to draw interesting conclusions about the repulsive core in the nucleon-nucleon interaction. The structure functions of atomic helium liquid drops indicate a smooth variation of S(k) with the number of atoms in the drop. The S/sub L/(k) of the /sup 4/He nucleus and nuclear matter are very similar for k > 1.5 fm/sup -1/, and it appears plausible that S/sub L/(k) of nuclei having A > 3 may not depend significantly on A when k > 1.5 fm/sup -1/.

10281 **Comparisons of four representations of the prompt neutron spectrum for the spontaneous fission of ^{252}Cf.** Madland, D.G.; Labauve, R.J.; Nix, J.R. (Los Alamos National Lab., NM, USA). *Radiation Effects;* **96**: No. 1-4, 103-108(Mar 1986). (CONF-850507—).

From International conference on nuclear data for basic and applied science; Santa Fe, NM, USA (13 May 1985).

We compare four representations of the prompt neutron spectrum for the spontaneous fission of ^{252}Cf with recent differential and integral measurements.

10282 **Mean fission neutron spectrum energies for ^{252}Cf and fissile nuclides ^{233}U, ^{235}U, ^{239}Pu and ^{241}Pu.** Holden, N.E. (Brookhaven National Lab., Upton, NY, USA). *Radiation Effects;* **96**: No. 1-4, 125-128(Mar 1986). (CONF-850507—).

From International conference on nuclear data for basic and applied science; Santa Fe, NM, USA (13 May 1985).

The spectra of prompt fission neutrons are of interest for the study of the neutron emission mechanism as well as for their relevance to the practical problems of nuclear reactors. The mean neutron energy of the fission spectrum directly impact the interpretation of experiments on the average number of prompt neutrons released in a fission. In order to make efficiency corrections in the measurements of the nubar ratio of the fissile nuclides to ^{252}Cf, the mean energy of each fission spectrum has been evaluated for these nuclides. There were not enough data available for the fissile nuclides to treat the problem of the dependence of the average energy of the fission spectrum on the incident neutron energy. In the case of ^{236}U, the mean energy is larger than earlier measurements indicated because the neglect of the effects of multiple scattering lowered the mean energy results for those earlier experiments.

10283 **Calculational tools for the evaluation of nuclear cross-section and spectra data.** Gardner, M.A. (Lawrence Livermore National Lab., CA, USA). *Radiation Effects;* **96**: No. 1-4, 139-150(Mar 1986). (CONF-850507—). Contract W-7405-ENG-48.

From International conference on nuclear data for basic and applied science; Santa Fe, NM, USA (13 May 1985).

Continued improvements in the calculational methods for obtaining nuclear reaction cross sections and spectra provide indispensable tools for nuclear data evaluations.

10284 **Nuclear decay data: some applications and needs.** Reich, C.W. (Idaho National Engineering Lab., Idaho Falls, USA). *Radiation Effects;* **93**: No. 1-4, 311-323(1986). (CONF-850507—).

From International conference on nuclear data for basic and applied science; Santa Fe, NM, USA (13 May 1985).

Nuclear decay data have broad relevance to a number of basic scientific disciplines as well as to many areas of technology. In this paper selected applications are discussed where decay data are making, or promise to make, important contributions. The following specific illustrations are discussed: the large body of precise new actinide-nuclide decay data produced through the work of the recently concluded IAEA Coordinated Research Program on the Measurement and Evaluation of Transactinium Isotope Nuclear Decay Data; the use of actinide-nuclide half-lives as reference standards in nuclear-data measurements; and the relevance of short-lived fission-product decay data to basic physics and reactor technology and some of the problems and challenges that they present to both theory and experiment.

6540 Radiation And Shielding Physics

REFER ALSO TO CITATION(S) 8863, 9022, 9083

10285 **(JAERI-M—87-123) ANISN-DD: one-dimensional Sn transport code using multi-group double-differential form cross sections.** Mori, Takamasa; Nakagawa, Masayuki; Sasaki, Makoto. (Japan Atomic Energy Research Inst., Tokyo). Aug 1987. 59p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE88751063/JAW.

A modified version of a one-dimensional Sn transport code ANISN has been developed on the basis of ANISN-JR. The present version is useful to solve neutron transport problems in materials with highly anisotropic scattering cross sections as encountered in neutronic calculations in fusion reactors. In order to treat accurately an anisotropy of scattering, the present code uses the multi-group double-differential form cross sections (DDX) instead of the conventional Legendre expansion method. As a result, the energy-angle correlation of scattering process can be accurately taken into account in a frame of the multi-group approximation. The present code has the following functions in addition to those of ANISN-JR: (1) forward transport calculation with external volume and/or shell sources by using a DDX library, (2) collapsing a macroscopic or microscopic DDX library into the one of fewer energy groups and fewer angle bins, (3) adjoint transport calculation by using a DDX library, (4) solving several types of eigenvalue problems by using a DDX library.

10286 **(LAL—87-18) Why haven't either Bothe or Joliot-Curie discovered the neutron.** Six, J. (Paris-11 Univ., 91 - Orsay (France). Lab. de l'Accelerateur Lineaire). Mar 1987. 22p. (In French). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88751753/JAW.

Papers on neutron discovery often leave obscure questions on W. Bothe and F. Joliot and I. Curie works. Those points are analysed. Bothe realized an experiment sensitive almost only to gamma radiation and it was difficult, in these conditions, to find the neutron. Conversely, it has been forgotten that he was a pioneer in discovery of a gamma radiation induced by nuclear transmutations. A careful analysis of Joliot-Curie work leads to a new explanation of their non-discovery of the neutron. The principal reason is shown to be probably the contemporary idea influence on possibilities of energy non-conservation in nuclear processes.

10287 **(ORNL—6268) The TORT three-dimensional discrete ordinates neutron/photon transport code.** Rhoades, W.A.; Childs, R.L. (Oak Ridge National Lab., TN (USA)). Nov 1987. Contract AC05-84OR21400. 177p. NTIS, PC A09/MF A01; 1; GPO Dep. Order Number DE88003650/JAW.

TORT is designed to solve very large two- or three-dimensional neutron and/or photon transport problems on a Cray or comparable computer using the method of discrete orginates. Extensive adaptability to new systems has been provided. Several flux solution procedures and acceleration methods are provided. The code can be used in stand-alone mode or under control of a driver. Problem specification requirements are similar to those of the DOT code, but are simpler and more convenient. The new zone specification format can be converted to a combinatorial geometry form for use in Monte Carlo codes. Several applications papers and a benchmark experiment relating to TORT have been produced. 70 refs., 3 figs., 9 tabs.

10288 **(RAL—86-041) Determination of the complete neutron scattering law S(k,w) from total scattering experiments using computed tomography.** Johnson, M.W. (Rutherford Appleton Lab., Chilton (UK)). May 1986. 13p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88750786/JAW.

The paper describes how the considerable body of knowledge on image reconstruction from path integrals (computed tomography) may be applied to total, time-of-flight neutron scattering experiments (ie those involving no experimental energy analysis) to obtain the neutron scattering law s(k,w), The feasibility in terms of possible instrument geometries and reconstruction algorithms is examined. It is possible that such reconstruction techniques may have wide application in the fields of neutron powder diffraction, amorphous scattering, liquids scattering and quasi-elastic incoherent scattering. A simple algorithm is presented which enables the tomographic problem with curved path integrals to be solved.

10289 **(RAL—86-042) Analysis of structure factor data on a pulsed source.** Howells, W.S. (Rutherford Appleton Lab., Chilton (UK)). May 1986. 20p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88750757/JAW.

The theory behind the analysis of time-of-flight data from a pulsed neutron source to produce the structure factor of liquids and amorphous materials is outlined.

6550 Medical Physics

REFER ALSO TO CITATION(S) 8478, 9425, 9481, 9482, 9763, 9849, 9853, 9854, 9855, 9856, 9861, 9865, 9874, 9875, 9890

10290 (CEA-DAS—337) Catalogue of standards at the Safety Analysis department library, the first of March 1987 CEA-DAS--69 report, revision 3. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. d'Analyse de Surete). 1987. 191p. (In French). NTIS (US Sales Only), PC A09/MF A01. Order Number DE88751722/JAW.

This report is a compilation of ANS and ANSI/ANS, ANSI/ASME american standards, Regulatory guides (Power Reactor Division), IEEE standards, to which are added ANSI american standards, AFNOR french standards, all of them being updated until to day. This computed compilation is divided into three parts: 1) main descriptor categories; 2) list of american standards in chronological order, list of AFNOR french standards, list of Regulatory guides in numerical order. 3) list of descriptors in alphabetic order.

10291 (CEPN—94) Methods for the determination of the man-Sievert monetary value. Lombard, J. (Centre d'Etude sur l'Evaluation de la Protection dans le Domaine Nucleaire, 92 - Fontenay-aux-Roses (France)). Mar 1986. 31p. (In French). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88751733/JAW.

To estimate the efficiency of radiological protection systems we have to compare the cost involved in putting each system into operation (cost of protection) to the collective dose that can thus be avoided. This comparison is facilitated if a man-Sievert monetary value is available. The man-Sievert value can be estimated from various detriments than can be attributed to this unitary exposure: whether there are lethal or non-lethal somatic effects, genetic effects and psycho-social effects. ICRP recommends, in its publication 37, to break down the cost of radiological detriment Y into two parts. The first part, $Y1=\alpha S$, corresponds to the somatic and genetic effects; the second part, $Y2=\beta$ ΣN/sub j/f(Hj), corresponds to the relevant effects of psycho-social considerations. This breakdown leads to the definition of two man-Sievert value components: α, which reflects somatic and genetic detriments; and β, which reflects the psycho-social effects. Several different methods can be used to determine α and β. Here, we will analyse the following: the a priori evaluation based on the Value of Human Life (VHL) or the costs of repair (for non-lethal effects); the a priori evaluation based on the loss of life expectancy; the evaluation based on what an individual would agree to give up to reduce the risk associated to a man Sievert-dose; the evaluation based on the expenses effectively incurred in the past to reduce the risk associated to a man-Sievert dose.

10292 (CEPN—104) Valuation of the health detriment cost. Lombard, J. (Centre d'Etude sur l'Evaluation de la Protection dans le Domaine Nucleaire, 92 - Fontenay-aux-Roses (France)). Sep 1986. 22p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88751734/JAW.

To estimate the efficiency of radiological protection systems we have to compare the cost involved in putting each system into operation (cost of protection) to the collective dose that can thus be avoided. This comparison is facilitated if a man-Sievert monetary value is available. The man-Sievert value can be estimated from various detriments that can be attributed to this unitary exposure: whether there are lethal or non-lethal somatic effects, genetic effects and psycho-social effects. ICRP recommends, in its publication 37, to break down the cost of radiological detriment Y into two parts. The first part, $Y1=\alpha S$, corresponds to the somatic and genetic effects; the second part, $Y2=\beta$ ΣN/sub j/f(Hj), corresponds to the relevant effects of psycho-social considerations. This breakdown leads to the definition of two man-Sievert value components: α, which reflects somatic and genetic detriments; and β, which reflects the psycho-social effects. Several different methods can be used to determine α and β. Here, we will analyse the following: the a priori evaluation based on the Value of Human Life (VHL) or the costs of repair (for non-lethal effects); the a priori evaluation based on the loss of life expectancy; the evaluation based on what an individual would agree to give up to reduce the risk associated to a man Sievert-dose; the evaluation based on the expenses effectively incurred in the past to reduce the risk associated to a man-Sievert dose.

10293 (INIS-GB—15) EDRP public local inquiry, UKAEA/BNFL precognition on: Environmental monitoring. Tyler, G.R. (UKAEA Headquarters, London; British Nuclear Fuels Ltd., Risley). Jan 1986. 42p. (DP—7). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88750738/JAW.

The comprehensive monitoring of radioactivity, which has been carried out to determine the exposure of the public to radiation resulting from operations at Dounreay Nuclear Establishment, is described. Details are given of the information arising from this monitoring. A brief introduction to the subject of ionizing radiations is included. (U.K.).

10294 (INIS-mf—11042, pp V68) **Radiation burden of children and adolescents by X-ray diagnostics - experience and conclusions.** Kraus, W.; Menzel, B. (Staatliches Amt fuer Atomsicherheit und Strahlenschutz, Berlin, German Democratic Republic). 1987. (In German). NTIS (US Sales Only), PC A09/MF A01. Order Number DE88780038/JAW. (CONF-870199—).

From 24. congress of the Society of Medical Radiology of the GDR; Leipzig, German D.R. (14 Jan 1987).

10295 (INIS-mf—11042, pp V70) **Organ doses in children and adults in standardized basic X-ray examinations.** Tautz, M.; Brandt, G.A.; Achterberg, N.; Padelt, S. (Staedtisches Klinikum Berlin-Buch, German Democratic Republic). 1987. (In German). NTIS (US Sales Only), PC A09/MF A01. Order Number DE88780038/JAW. (CONF-870199—).

From 24. congress of the Society of Medical Radiology of the GDR; Leipzig, German D.R. (14 Jan 1987).

10296 (INIS-mf—11042, pp V171) **Ascertainment of organ doses from tables in biomedical radiography.** Angerstein, W.; Gosch, D.; Wolf, M. (Karl-Marx-Universitaet, Leipzig, German Democratic Republic. Radiologische Klinik). 1987. (In German). NTIS (US Sales Only), PC A09/MF A01. Order Number DE88780038/JAW. (CONF-870199—).

From 24. congress of the Society of Medical Radiology of the GDR; Leipzig, German D.R. (14 Jan 1987).

10297 (INIS-mf--11042, pp V176) **Radiation exposure of infants by comparative radiography of the hip using special gonad shields - phantom and in practice measurements.** Petrik, R.; Reumuth, H.J.; Plessow, B.; Menzel, B.; Thoms, G. (Bezirkskrankenhaus Stralsund, German Democratic Republic; Staatliches Amt fuer Atomsicherheit und Strahlenschutz, Berlin, German Democratic Republic). 1987. (In German). NTIS (US Sales Only), PC A09/MF A01. Order Number DE88780038/JAW. (CONF-870199—).

From 24. congress of the Society of Medical Radiology of the GDR; Leipzig, German D.R. (14 Jan 1987).

10298 (INIS-mf—11048, pp 155) **Method for comparing radiation doses at installation for deep X-ray therapy with thermoluminescent dosimeters.** Konstantinov, B.; Ivanova, K.; Penchev, V. (Nauchno-Izsledovatelski Onkologichen Inst., Sofia, Bulgaria). Oct 1985. (In Bulgarian). NTIS (US Sales Only), PC A09/MF A01. Order Number DE88780035/JAW. (CONF-8510479—).

From 6. national congress of roentgenology, radiology and radiobiology; Sofia, Bulgaria (4 Oct 1985).

10299 (INIS-mf—11048, pp 156) **Telegammatherapy of the central nervous system at acute lymphoblast leucosis.** Ruseva, Ts.; Penchev, V.; Dobrev, D. (Nauchno-Izsledovatelski Onkologichen Inst., Sofia, Bulgaria). Oct 1985. (In Bulgarian). NTIS (US Sales Only), PC A09/MF A01. Order Number DE88780035/JAW. (CONF-8510479—).

From 6. national congress of roentgenology, radiology and radiobiology; Sofia, Bulgaria (4 Oct 1985).

10300 (INIS-mf—11048, pp 177) **Expedience estimation of prophylactic fluorographic studies in large numbers - an analysis based on the benefit/harm changes in different age groups.** Vasilev, F.; Ingilizova, K. (Meditsinska Akademiya, Sofia, Bulgaria. Nauchen Inst. po Rentgenologiya i Radiobiologiya). Oct 1985. (In Bulgarian). NTIS (US Sales Only), PC A09/MF A01. Order Number DE88780035/JAW. (CONF-8510479—).

From 6. national congress of roentgenology, radiology and radiobiology; Sofia, Bulgaria (4 Oct 1985).

10301 (INIS-mf—11048, pp 177) **Radiation hazard for occupationally irradiated persons.** Vasilev, G. (Meditsinska Akademiya, Sofia, Bulgaria. Nauchen Inst. po Rentgenologiya i Radiobiologiya). Oct 1985. (In Bulgarian). NTIS (US Sales Only), PC A09/MF A01. Order Number DE88780035/JAW. (CONF-8510479—).

From 6. national congress of roentgenology, radiology and radiobiology; Sofia, Bulgaria (4 Oct 1985).

10302 (INIS-mf—11048, pp 179-180) **Optimization of centralized personnel dosimetry.** Karadzhov, A. (Meditsinska Akademiya, Sofia, Bulgaria. Nauchen Inst. po Rentgenologiya i Radiobiologiya). Oct 1985. (In Bulgarian). NTIS (US Sales Only), PC A09/MF A01. Order Number DE88780035/JAW. (CONF-8510479—).

From 6. national congress of roentgenology, radiology and radiobiology; Sofia, Bulgaria (4 Oct 1985).

10303 (INIS-mf—11048, pp 180) **On the principles of the current system for personnel dosimetry.** Karadzhov, A. (Meditsinska Akademiya, Sofia, Bulgaria. Nauchen Inst. po Rentgenologiya i Radiobiologiya). Oct 1985. (In Bulgarian). NTIS (US Sales Only), PC A09/MF A01. Order Number DE88780035/JAW. (CONF-8510479—).

From 6. national congress of roentgenology, radiology and radiobiology; Sofia, Bulgaria (4 Oct 1985).

10304 (INIS-mf—11048, pp 181) **Radiation fields characteristics at some production operations in radiodefectoscopy.** Asparukhov, G. (Meditsinska Akademiya, Sofia, Bulgaria. Nauchen Inst. po Rentgenologiya i Radiobiologiya). Oct 1985. (In Bulgarian). NTIS (US Sales Only), PC A09/MF A01. Order Number DE88780035/JAW. (CONF-8510479—).

From 6. national congress of roentgenology, radiology and radiobiology; Sofia, Bulgaria (4 Oct 1985).

10305 (INIS-mf—11048, pp 182) **Radiation hazards of the personnel in underground nonuranium mines, radiation burden of 'bronchial tree' (alpha radiation) and whole body (gamma radiation).** Vyrbanov, G.; Cheresharov, I.; Popov, V. (Meditsinska Akademiya, Sofia, Bulgaria. Nauchen Inst. po Rentgenologiya i Radiobiologiya). Oct 1985. (In Bulgarian). NTIS (US Sales Only), PC A09/MF A01. Order Number DE88780035/JAW. (CONF-8510479—).

From 6. national congress of roentgenology, radiology and radiobiology; Sofia, Bulgaria (4 Oct 1985).

10306 (INIS-mf—11048, pp 183-184) **Attempt for film detection of the individual radon exposition.** Ivanov, Z.; Todorov, A.; Najdenov, I.; Buryan, I. (Meditsinska Akademiya, Sofia, Bulgaria. Nauchen Inst. po Rentgenologiya i Radiobiologiya). Oct 1985. (In Bulgarian). NTIS (US Sales Only), PC A09/MF A01. Order Number DE88780035/JAW. (CONF-8510479—).

From 6. national congress of roentgenology, radiology and radiobiology; Sofia, Bulgaria (4 Oct 1985).

10307 (INIS-mf—11048, pp 188-189) **Dosimetric control at transthoracal thin-needle aspiration biopsy.** Todorov, V.; Kyrdzhiev, V.; Benov, E. Oct 1985. (In Bulgarian). NTIS (US Sales Only), PC A09/MF A01. Order Number DE88780035/JAW. (CONF-8510479—).

From 6. national congress of roentgenology, radiology and radiobiology; Sofia, Bulgaria (4 Oct 1985).

10308 (INIS-mf—11048, pp 189) **Isocentric telegammatherapy of maxillary sinus neoplasms.** Panova, V.; Milchev, V. Oct 1985. (In Bulgarian). NTIS (US Sales Only), PC A09/MF A01. Order Number DE88780035/JAW. (CONF-8510479—).

From 6. national congress of roentgenology, radiology and radiobiology; Sofia, Bulgaria (4 Oct 1985).

10309 (INIS-mf—11048, pp 161) **Test for dislocation determination of the diaphragm axis rotation toward the source axis at telegammatherapeutic devices.** Grigorov, A. Oct 1985. (In Bulgarian). NTIS (US Sales Only), PC A09/MF A01. Order Number DE88780035/JAW. (CONF-8510479—).

From 6. national congress of roentgenology, radiology and radiobiology; Sofia, Bulgaria (4 Oct 1985).

10310 (INIS-mf—11048, pp 181) **Occupations with increased radiation hazards - dosimetric and statistical evaluations. Analysis of the situation in Bulgaria during 1980-1984.** Asparukhov, G.; Vyrbanov, P.; Vasilev, G. (Meditsinska Akademiya, Sofia, Bulgaria. Nauchen Inst. po Rentgenologiya i Radiobiologiya). Oct 1985. (In Bulgarian). NTIS (US Sales Only), PC A09/MF A01. Order Number DE88780035/JAW. (CONF-8510479—).

From 6. national congress of roentgenology, radiology and radiobiology; Sofia, Bulgaria (4 Oct 1985).

10311 (INIS-mf—11054, pp 37) **Radiation burden on human muscle tissue from caesium 137.** Rabitsch, H.; Feenstra, O.; Mueller, H. (Technische Univ., Graz, Austria. Inst. fuer Theoretische Physik und Reaktorphysik; Graz Univ., Austria; Verein zur Foerderung der Anwendung der Kernenergie, Graz, Austria. Reaktorinstitut). Sep 1987. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88700772/JAW. (CONF-8709196—).

From Annual convention fo the Austrian Physical Society; Vienna, Austria (21 Sep 1987).

10312 (INIS-mf—11060, pp vp) **Bone and tissue-equivalent phantoms for radiation exposure determination.** Edelmann, B.U.; Mielcarek, J.; Taschner, P. (Staatliches Amt fuer Atomsicherheit und Strahlenschutz, Berlin, German Democratic Republic). 1987. (In German). NTIS (US Sales Only), PC A07/MF A01. Order Number DE88780036/JAW. (CONF-870199—).

From 24. congress of the Society of Medical Radiology of the GDR; Leipzig, German D.R. (14 Jan 1987).

10313 **(JAERI-M—87-099) ALI and DAC for transuranic elements based on the metabolic data presented in ICRP Publication 48.** Togawa, Orihiko; Yamaguchi, Yukichi; Homma, Toshimitsu. (Japan Atomic Energy Research Inst., Tokyo). Jul 1987. 297p. NTIS (US Sales Only), PC A13/MF A01. Order Number DE88751056/JAW.

The recently published ICRP report, ICRP Publication 48, presents the new metabolic data of some transuranic elements, compared with those employed in the calculation of ALI and DAC in ICRP Publication 30. Values of ALI and DAC for 72 radionuclides were calculated using the metabolic data presented in the Publication 48. The calculation was performed by a computer code system DOSDAC, which can systematically calculate ALI and DAC by the same method as that described in the Publication 30. The calculated values of ALI and DAC were tabulated in the same format as

that of the supplements to the Publication 30. For the convenience of using in the dose assessment, also given are values of committed effective dose equivalent per intake of unit activity. It is expected that these values will be applied to the radiation protection purposes.

10314 **Multi-purpose use of a modified X-ray machine.** Yalcintas, M.G. (Health and Safety Research Div., Oak Ridge National Lab., P.O. Box X, Building 7503, Oak Ridge, TN 37831). pp 68-78 of Health physics of radiation generating machines 20th midyear topical symposium. Swanson, W.P.; Busick, D.D. Springfield, VA; National Technical Information Service (1987). (CONF-870219—).

From 20. midyear topical symposium of the Health Physics Society: health physics of radiation-producing machines; Reno, NV, USA (8 Feb 1987).

An X-ray therapy machine was modified to construct an X-ray facility to perform experiments meeting the following criteria: (1) provides wide range of operating capabilities; (2) simulates diagnostic X-rays; (3) produces minimum scatter; and (4) permits stable and reproducible output. The system was operated in the application of a spectrometric dosimetry system to use in experiments simulating medical diagnostic X-ray exposure configurations on antropomorphic phantoms. The graduate and undergraduate students who are taking the radiation biology course, use the facility to perform laboratory experiments. Studies were conducted to investigate the magnitude of variation of dose from the photons coming from above and below the horizontal direction (to Alderson RANDO phantom containing TLDs) representing the air exposure above 1 m and ground surface exposure, respectively. The calibrations of personnel dosimeters are also performed in this facility.

10315 **Beta fields and measurement practices at DOE facilities.** Swinth, K.L.; Rathbun, L.A.; Brackenbush, L.W. (Pacific Northwest Lab., Richland, WA, USA). *Radiation Protection Dosimetry;* 14: No. 2, 105-108(1986). (CONF-8510185—). Contract AC06-76RL01830.

From Workshop on dosimetry of beta particles and low energy X-rays; Paris, France (7 Oct 1985).

The beta measurement problem at DOE facilities was assessed through the use of a questionnaire and field visits to selected facilities. At 35% of the facilities, the radiation exposures from beta emitting radionuclides are high enough that they must be considered in establishing protection requirements. Measurements were made in several facilities using scintillators, a surface barrier detector plus various dosemeters and survey instruments. Beta dose rates of several $mGy.h^{-1}$ were not unusual and beta gamma ratios of greater than 30:1 were frequently observed. The agreement between the various measurement techniques was frequently unacceptable.

6560 Condensed Matter Physics

REFER ALSO TO CITATION(S) 9038, 9055, 9057, 9058, 9086, 9089, 9094, 9142, 9143, 9145, 9174, 9272, 9328, 10028, 10157, 10250, 10254

10316 **(AERE-M—3531) Optimisation of uniform ion doping of materials.** Shaibani, S.J. (UKAEA Atomic Energy Research Establishment, Harwell. Materials Development Div.). Jan 1986. 28p. H.M. Stationery Office, London, price Pound 5.00.

A simple algorithm has been devised to calculate the ion beam energies required to ensure optimum uniformity of doping throughout the depth of a material. The optimisation procedure uses range-energy data for the ion beam/material interaction as input to a computer program incorporating the algorithm. The technique is illustrated by three examples, all of which have irregularities in the overall doping level restricted to less than 2 per cent.

10317 **(AERE-R—12117) Feasibility study on pre-amorphisation with Ge ions followed by RTA for junction depth control in silicon.** Woods, T.A.; Bishop, H.E.; Chivers, D.; Dearnaley, G.; Gardner, P.R.; Harper, R.; Totterdell, D.H.J. (UKAEA Atomic Energy Research Establishment, Harwell. Nuclear Physics Div.). Feb 1986. 18p. H.M. Stationery Office, London, price Pound 4.00.

A feasibility study on pre-amorphisation with Ge ions followed by rapid thermal annealing [GERTA process] for junction depth control in silicon was carried out. The study showed that the GERTA process could reduce channelling and radiation enhanced diffusion in emitter-base junctions formed with boron implanted dopants. B^+ doped regions with depths significantly reduced compared to B^+ only implants were obtained.

10318 **(CONF-870701—10) Introductory review: Physics of electron slowing-down processes.** Inokuti, Mitio. (Argonne National Lab., IL (USA)). 1987. Contract W-31109-ENG-38. 6p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88002918/JAW.

From 8. international congress of radiation research; Edinburgh, UK (19 Jul 1987).

This paper briefly discusses selected topics on the physics of electron slowing-down processes. Included are: new developments in electron degradation theory; the behavior of electrons in solid films; and analysis of the energy spectra of electrons ejected from solid surfaces. 6 refs. (LSP)

10319 **(CONF-870733—14) Calculated sputtering and atomic displacement cross-sections for applications to medium voltage analytical electron microscopy.** Bradley, C.R.; Zaluzec, N.J. (Argonne National Lab., IL (USA)). Aug 1987. Contract W-31109-ENG-38. 17p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88002904/JAW.

From Pacific workshop and meeting on analytical electron microscopy; Kona, HI, USA (12 Jul 1987).

The development of medium voltage electron microscopes having high brightness electron sources and ultra-high vacuum environments has been anticipated by the microscopy community now for several years. The advantages of such a configuration have been discussed to great lengths, while the potential disadvantages have for the most part been neglected. The most detrimental of these relative to microcharacterization are the effects of electron sputtering and atomic displacement to the local specimen composition. These effects have in the past been considered mainly in the high voltage electron microscope regime and generally were ignored in lower voltage instruments. Recent experimental measurements have shown that the effects of electron sputtering as well as radiation induced segregation can be observed in conventional transmission electron microscopes. It is, therefore, important to determine at what point the effects will begin to manifest themselves in the new generation of medium voltage analytical electron microscopes. In this manuscript we present new calculations which allow the individual experimentalist to determine the potential threshold levels for a particular elemental system and thus avoid the dangers of introducing artifacts during microanalysis. 12 refs., 3 figs.

10320 **(CONF-871125—14) Depth of origin of sputtered atoms: Experimental and theoretical study of Cu/Ru(0001).** Burnett, J.W.; Biersack, J.P.; Gruen, D.M.; Joergensen, B.; Krauss, A.R.; Pellin, M.J.; Schweitzer, E.L.; Yates, J.T. Jr.; Young, C.E. (Argonne National Lab., IL (USA); Pittsburgh Univ., PA (USA). Surface Science Center; Hahn-Meitner-Institut fuer Kernforschung Berlin G.m.b.H. (Germany, F.R.)). 1987. Contract W-31109-ENG-38. 16p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88002848/JAW.

From 34. national vacuum symposium and topical conference; Anaheim, CA, USA (2 Nov 1987).

The depth of origin of sputtered atoms is a subject of considerable interest. The surface sensitivity of analytical techniques such as Secondary Ion Mass Spectrometry (SIMS) and Surface Analysis by Resonance Ionization of Sputtered Atoms (SARISA), and the sputtering properties of strongly segregating alloy systems, are critically dependent on the sputtering depth of origin. A significant discrepancy exists between the predictions of the Sigmund theory and computer sputtering models; in general, the computer models predict a much shallower depth of origin. The existing experimental evidence suggests that most of the sputtered atoms originate in the topmost atomic layer, but until recently, the results have not been definitive. We have experimentally determined the depth of origin of atoms sputtered from surfaces consisting of Cu films of less than two monolayers on a Ru(0001) substrate. The Cu/Ru target was

statically sputtered using 3.6 keV Ar^+. The sputtered neutrals were non-resonantly laser ionized and detected using SARISA. The Cu/Ru sputtering yield ratio and the suppression of the Ru sputtering yield were determined for various Cu coverages. The results indicate that the majority of the sputtered atoms originate in the topmost atomic layer. The Cu/Ru system is also modeled using a modified Transport of Ions in Matter (TRIM) code. It was found that TRIM C does not correctly treat the first atomic layer, resulting in a serious underestimate of the number of sputtered atoms which originate in this layer. The corrected version adequately describes the results, predicting that for the experimental conditions roughly two-thirds of the sputtered atoms originate in the first atomic layer. These results are significantly greater than the Sigmund theory estimate of >40%. 26 refs., 3 figs., 1 tab.

10321 (CONF-8608202—1-Vugraphs) **Ion beam and defect-related research in the Solid State Division.** Roberto, J.B. (Oak Ridge National Lab., TN (USA)). 5 Aug 1986. Contract AC05-84OR21400. 20p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88001736/JAW.

From OBES/DMS contractors meeting on radiation effects; Los Alamos, NM, USA (5 Aug 1986).

This paper contains viewgraphs on the topic of radiation effects of solid state materials. In particular, it elaborates on ion beam deposition of thin film structures, ion implantation damage in crystals of Al_2O_3, and ion implanted optical waveguides in $LiNbO_3$. (LSP)

10322 (CONF-8708112—3) **The role of thermodynamic phase diagrams and lattice matching in superlattice growth.** Schuller, I.K. (Argonne National Lab., IL (USA)). Aug 1987. Contract W-31109-ENG-38. 12p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88003113/JAW.

From 3. international conference on superlattices, microstructures and microdevices; Chicago, IL, USA (17 Aug 1987).

Metallic superlattices exhibit a correlation between the epitaxial growth temperature and temperatures extracted from the equilibrium thermodynamic phase diagram. This correlation together with molecular dynamics simulation of epitaxial growth indicates that thermodynamics plays an important role in the growth of epitaxial films, particularly in limiting the sharpness of the interfaces.

10323 (INIS-BR—901) **Proceedings of the Latin American Symposium of Physics of Amorphous Systems - Vol. 1.** (Centro Latino Americano de Fisica, Rio de Janeiro (Brazil); Universidade Federal Fluminense, Niteroi (Brazil)). 1984. 269p. (In Portuguese). (CONF-8402101—). NTIS (US Sales Only), PC A12/MF A01. Order Number DE88700661/JAW.

From Simposio Latino-Am. de Fis. dos sistemas amorfos; Niteroi, Brazil (1 Feb 1984).

The main physical properties of amorphous systems are examined and an general overview of this subject as a matter of active research is presented. The amorphous systems contain a rich phenomenology without a reasonable explanation up to now and can yield a sort of technological applications, this represents a stimulus for scientists and technologists. (MWO).

10324 (INIS-BR—901, pp 1-91) **Theory of glass.** Rivier, N. (Imperial Coll. of Science and Technology, London, UK. Blackett Lab.). 1984. NTIS (US Sales Only), PC A12/MF A01. Order Number DE88700661/JAW. (CONF-8402101—).

From Simposio Latino-Am. de Fis. dos sistemas amorfos; Niteroi, Brazil (1 Feb 1984).

A general overview of the main properties of glassy materials is provided. The use of topological methods, gange invariance properties and statistical crystallography is presented in detail. A new step further on the issue of describing and classfying amorphous materials is given. (MWO).

10325 (INIS-BR—901, pp 92-109) **Phase transitions in glassy materials.** Thorpe, M.F. (Michigan State Univ., East Lansing, USA. Dept. of Physics and Astronomy). 1984. NTIS (US Sales Only), PC A12/MF A01. Order Number DE88700661/JAW. (CONF-8402101—).

From Simposio Latino-Am. de Fis. dos sistemas amorfos; Niteroi, Brazil (1 Feb 1984).

We examine the mechanical properties of covalent random networks with high and low mean coordination. It is shown that networks with high mean coordination (amorphous solids) have elastic constants determined by the covalent forces whereas networks with low mean coordination (polymeric glasses) have elastic constants determined by the longer range molecular forces. These ideas can be made rigorous by considering the number of continuous deformations (i.e. zero frequency modes) allowed within the network. In the transition from one kind of network to another, rigidity percolates through the system. This leads to a picture in which polymeric glasses have large floppy or spongy regions with a few rigid inclusions. On the other hand in amorphous solids, the rigid regions have percolated to form a rigid solid with a few floppy or spongy inclusions.

10326 (INIS-BR—901, pp 110-127) **Metallic glasses: structural models.** Nassif, E. (Buenos Aires Univ. Nacional, Argentina. Facultad de Ingenieria). 1984. NTIS (US Sales Only), PC A12/MF A01. Order Number DE88700661/JAW. (CONF-8402101—).

From Simposio Latino-Am. de Fis. dos sistemas amorfos; Niteroi, Brazil (1 Feb 1984).

The aim of this work is to give a summary of the attempts made up to the present in order to discribe by structural models the atomic arrangement in metallic glasses, showing also why the structure factors and atomic distribution functions cannot be always experimentally determined with a reasonable accuracy. (M.W.O.).

10327 (INIS-BR—901, pp 128-143) **Amorphous metals-Fabrication and characterization.** Missell, F.P. (Sao Paulo Univ., Brazil. Inst. de Fisica). 1984. NTIS (US Sales Only), PC A12/MF A01. Order Number DE88700661/JAW. (CONF-8402101—).

From Simposio Latino-Am. de Fis. dos sistemas amorfos; Niteroi, Brazil (1 Feb 1984).

We present a review of the principal methods used to prepare metallic alloys in the amorphous phase, focussing on two which have come into widespread use: melt-spinning and sputtering. Methods of characterizing the amorphous state are discussed. Finnaly we discuss briefly a kinetic approach to understanding the formation of mettalic glasses.

10328 (INIS-BR—901, pp 186-200) **Electron density of states in metallic glasses.** Frota-Pessoa, S. (Sao Paulo Univ., Brazil. Inst. de Fisica). 1984. (In Portuguese). NTIS (US Sales Only), PC A12/MF A01. Order Number DE88700661/JAW. (CONF-8402101—).

From Simposio Latino-Am. de Fis. dos sistemas amorfos; Niteroi, Brazil (1 Feb 1984).

A general survey on the issue of calculating the electron density of states in metallic glasses is provided. A special emphasis is given to amorphos alloys of transition metals. (MWO).

10329 (INIS-BR—901, pp 201-220) **Real space renormalization techniques for disordered systems.** Anda, E.V. (Universidade Federal Fluminense, Niteroi, Brazil. Inst. de Fisica). 1984. NTIS (US Sales Only), PC A12/MF A01. Order Number DE88700661/JAW. (CONF-8402101—).

From Simposio Latino-Am. de Fis. dos sistemas amorfos; Niteroi, Brazil (1 Feb 1984).

Real space renormalization techniques are applied to study different disordered systems, with an emphasis on the understanding of the electronic properties of amorphous matter, mainly semiconductors.

10330 (INIS-BR—901, pp 221-231) **Research on hydrogenated amorphous silicon and related alloys for photovoltaiv applications.** Chambouleyron, I. (Universidade Estadual de Campinas, Brazil. Inst. de Fisica). 1984. NTIS (US Sales Only), PC A12/MF A01. Order Number DE88700661/JAW. (CONF-8402101—).

From Simposio Latino-Am. de Fis. dos sistemas amorfos; Niteroi, Brazil (1 Feb 1984).

An overview of the main activities on amorphous materials of photovoltaic interest performed at the Photovoltaic Conversion Laboratory at UNICAMP is presented. The laboratory is actively engaged in a research program concerning hidrogenated amorphous semiconductors and devices. (MWO).

10331 (INIS-BR—901, pp 232-244) **Generalized Slater-Pauling construction for magnetic amorphous alloys.** Malozemoff, A.P.; Williams, A.R.; Moruzzi, V.L. (IBM Watson Research Center, Yorktown Heights, NY, USA). 1984. NTIS (US Sales Only), PC A12/MF A01. Order Number DE88700661/JAW. (CONF-8402101—).

From Simposio Latino-Am. de Fis. dos sistemas amorfos; Niteroi, Brazil (1 Feb 1984).

The concept of magnetic valence and a generalized Slater-Pauling construction permit a consistent interpretation of the ferromagnetism of both transition metal and metalloid alloys with Fe, Co and Ni. Amorphous alloys like CoB, CoSi, FeB and FeSi are revealed to be strong ferromagnets with a constant number of majority-spin sp electrons over a certain composition range.

10332 (INIS-BR—901, pp 245-257) **Amorphous magnetism.** Rechenberg, H.R. (Sao Paulo Univ., Brazil. Inst. de Fisica). 1984. NTIS (US Sales Only), PC A12/MF A01. Order Number DE88700661/JAW. (CONF-8402101—).

From Simposio Latino-Am. de Fis. dos sistemas amorfos; Niteroi, Brazil (1 Feb 1984).

The consequences of disorder on magnetic properties of solids are examined. In this context the word 'disorder' is not synonimous of structural amorphicity; chemical disorder can be achieved e.g. by randomly diffusing magnetic atoms on a nonmagnetic crystalline lattice. The name Amorphous Magnetism must be taken in a broad sense.

10333 (INIS-BR—901, pp 258-264) **Reentrant ferromagnetism.** Continentino, M.A. (Universidade Federal Fluminense, Niteroi, Brazil. Inst. de Fisica). 1984. NTIS (US Sales Only), PC A12/MF A01. Order Number DE88700661/JAW. (CONF-8402101—).

From Simposio Latino-Am. de Fis. dos sistemas amorfos; Niteroi, Brazil (1 Feb 1984).

We briefly review the problem of reentrant ferromagnetism with particular emphais on the controversy between coexistence or reentrant behaviour. We discuss a cluster and a glassy model which are relevant for the understanding of the properties of these materials. We find that for a ferromagnetic instability to occur it is essential the existence of non-colinearity or an anisotropic coupling between spins.

10334 **(INIS-BR—903) Proceedings of the Latin American Symposium of Physics of Amorphous Systems - Vol. 2.** (Centro Latino Americano de Fisica, Rio de Janeiro (Brazil); Universidade Federal Fluminense, Niteroi (Brazil)). 1984. 265p. (In Portuguese). (CONF-8402101—). NTIS (US Sales Only), PC A12/MF A01. Order Number DE88700663/JAW.

From Simposio Latino-Am. de Fis. dos sistemas amorfos; Niteroi, Brazil (1 Feb 1984).

The main physical properties of amorphous systems are examined and an general overview of this subject as a matter of active research is presented. The amorphous systems contain a rich phenomenology without a reasonable explanation up to now and can yield a sort of technological applications, this represents a stimulus for scientists and technologists. (M.W.O).

10335 (INIS-BR—903, pp 265-278) **Expanded fluid mercury, a ferroelectric excitonic insulator.** Cohen, M.H.; Turkevich, L.A. (Exxon Research and Engineering Co., Annandale, NJ, USA. Corporate Research Science Lab.; Princeton Univ., NJ, USA. Dept. of Physics). 1984. NTIS (US Sales Only), PC A12/MF A01. Order Number DE88700663/JAW. (CONF-8402101—).

From Simposio Latino-Am. de Fis. dos sistemas amorfos; Niteroi, Brazil (1 Feb 1984).

We relate the metal-nonmetal transition in expanded liquid mercury to the dieletric transition in dense mercury vapor. We propose that the high-temperature, high-pressure fluid is an excitonic insulator phase. Condensation of Frenkel excitons is shown to occur at the dieletric transition. The phase diagram of excitonic insulator explains naturally both the metal-nonmetal and the dieletric transitions. The permanent dipole moments of the condensed excitons are estimated to order as a ferroelectric phase. The critical exponents of the liquid-gas transition are therefore classical within the ferroelectric excitonic insulator phase, crossing over 3d Ising at the ferroelectric-paraelectric transition. (The authors).

10336 (INIS-BR—903, pp 279-288) **Memory function formalism applied to electronic transport in disordered systems.** Cunha Lima, I.C. da. (Instituto de Pesquisas Espaciais, Sao Jose dos Campos, Brazil). 1984. NTIS (US Sales Only), PC A12/MF A01. Order Number DE88700663/JAW. (CONF-8402101—).

From Simposio Latino-Am. de Fis. dos sistemas amorfos; Niteroi, Brazil (1 Feb 1984).

Memory function formalism is briefly reviewed and applied to electronic transport using the projection operator technique. The resistivity of a disordered 2-D electron gas under strong magnetic field is obtained in terms of force-force correlation function.

10337 (INIS-BR—903, pp 289-295) **Effects of Structural Correlations on Electronic Properties.** Pastawski, H.M.; Weisz, J.F. (Instituto de Desarrollo Tecnologico para la Industria Quimica, Santa Fe, Argentina). 1984. NTIS (US Sales Only), PC A12/MF A01. Order Number DE88700663/JAW. (CONF-8402101—).

From Simposio Latino-Am. de Fis. dos sistemas amorfos; Niteroi, Brazil (1 Feb 1984).

A one dimensional alloy model is treated in the nearest neighbour tight binding approximation in which the correlation of the atoms can be adjusted. The correlation can be changed from a situation in which there is a tendency for atoms to alternate to a situation in which the atoms are randomly located, consistent with a fixed concentration c for A /sub c/ B/sub 1-c/. The results show that when there is short range order, at certain energies there is a tendency for localized states and formation of structure induced minimum in the density of states. The results for the ordered case are similar to those of Charge Density Wave (CDW). A smooth transition is carried out between this case and the randomly disordered case which behaves like the Anderson model for uncorrelated disorder. (M.W.O.).

10338 (INIS-BR—903, pp 296-304) **Chaotic renormalization group approach to disordered systems.** Oliveira, P.M.C. de; Continentino, M.A.; Makler, S.S.; Anda, E.V. (Universidade Federal Fluminense, Niteroi, Brazil. Inst. de Fisica). 1984. NTIS (US Sales Only), PC A12/MF A01. Order Number DE88700663/JAW. (CONF-8402101—).

From Simposio Latino-Am. de Fis. dos sistemas amorfos; Niteroi, Brazil (1 Feb 1984).

We study the eletronic properties of the disordered linear chain using a technique previously developed by some of the authors for an ordered chain. The equations of motion for the one electron Green function are obtained and the configuration average is done according to the GK scheme. The dynamical problem is transformed, using a renormalization group procedure, into a bidimensional map. The properties of this map are investigated and related to the localization properties of the eletronic system.

10339 (INIS-BR—903, pp 305-308) **Charge distribution and local disorder in hard sphere fluids.** Weissmann, M.; Cohan, N.V. (Comision Nacional de Energia Atomica, Buenos Aires, Argentina. Dept. de Fisica). 1984. NTIS (US Sales Only), PC A12/MF A01. Order Number DE88700663/JAW. (CONF-8402101—).

From Simposio Latino-Am. de Fis. dos sistemas amorfos; Niteroi, Brazil (1 Feb 1984).

The simulation of a hard sphere fluid by a totally random configuration is performed. The relation of the charge distribution of this system and its geometrical configuration is examined. (M.W.O.).

10340 (INIS-BR—903, pp 309-311) **Self-consistent approach to the eletronic problem in disordered solids.** Taguena-Martinez, J.; Barrio, R.A.; Martinez, E.; Yndurain, F. (Universidad Nacional Autonoma de Mexico, Mexico City. Inst. de Investigaciones en Materiales; Universidad Autonoma de Madrid, Spain. Dept. de Fisica Fundamental). 1984. NTIS (US Sales Only), PC A12/MF A01. Order Number DE88700663/JAW. (CONF-8402101—).

From Simposio Latino-Am. de Fis. dos sistemas amorfos; Niteroi, Brazil (1 Feb 1984).

It is developed a simple formalism which allows us to perform a self consistent non-parametrized calculation in a non-periodic system, by finding out the thermodynamically averaged Green's function of a cluster Bethe lattice system.

10341 (INIS-BR—903, pp 316-320) **Aggregate model for determination of impurity states in crystals.** Guimaraes, P.S. (Instituto de Pesquisas Espaciais, Sao Jose dos Campos, Brazil). 1984. (In Portuguese). NTIS (US Sales Only), PC A12/MF A01. Order Number DE88700663/JAW. (CONF-8402101—).

From Simposio Latino-Am. de Fis. dos sistemas amorfos; Niteroi, Brazil (1 Feb 1984).

It is proposed a self-consistent model of first principles for the determination of the electronic structure of deep defects in insulators, which is an improvement of the crystalline aggregate method proposed for the study of perfect crystals. It is shown that, with a proper choice of the aggregate, it reduces to the formal self-consistent solution of the defect problem in the Wannier representation. This procedure is applied with sucess to an U center in NaCl. (M.W.O.).

10342 (INIS-BR—903, pp 321-326) **Indirect gap semiconductor model with large impurity concentration.** Makler, S.S.; Figueira, M.S.; Anda, E.V. (Universidade Federal Fluminense, Niteroi, Brazil. Inst. de Fisica). 1984. (In Portuguese). NTIS (US Sales Only), PC A12/MF A01. Order Number DE88700663/JAW. (CONF-8402101—).

From Simposio Latino-Am. de Fis. dos sistemas amorfos; Niteroi, Brazil (1 Feb 1984).

In this work we describe the impurity bands resulting from the enlargement of the A/sub 1/,T/sub 2/,E and D/sup -/ levels of the donors in Si at intermediary concentrations. These bands are described by a tight-binding Hamiltonian with two base orbitals per site, explicitly including a local Coulombic repulsion. The base orbitals contain both a tetrahedral symmetry as well as a the Bloch's oscilatory factor. The particular case Si:P is explicitly calculated. (M.W.O.).

10343 (INIS-BR—903, pp 327-333) **Impurity states in two - and three-dimensional disordered systems.** Silva, A.F. da; Fabbri, M. (Instituto de Pesquisas Espaciais, Sao Jose dos Campos, Brazil). 1984. NTIS (US Sales Only), PC A12/MF A01. Order Number DE88700663/JAW. (CONF-8402101—).

From Simposio Latino-Am. de Fis. dos sistemas amorfos; Niteroi, Brazil (1 Feb 1984).

We investigate the microscopic structure of the impurity states in two-and three-dimensional (2D and 3d) disordered systems. A cluster model is outlined for the donor impurity density of states (DIDS) of doped semiconductors. It is shown that the impurity states are very sensitive to a change in the dimensionality of the system, i.e from 3D to 2D system. It is found that all eigenstates become localized in 2D disordered system for a large range of concentration.

10344 (INIS-BR—903, pp 334-338) **2-D impurity states associated with inversion layers.** Cunha Lima, I.C. da; Guimaraes, P.S.; Silva, A.F. da; Senna, J.R. (Instituto de Pesquisas Espaciais, Sao Jose dos Campos, Brazil). 1984. NTIS (US Sales Only), PC A12/MF A01. Order Number DE88700663/JAW. (CONF-8402101—).

From Simposio Latino-Am. de Fis. dos sistemas amorfos; Niteroi, Brazil (1 Feb 1984).

We obtain the density of states for electrons at the inversion layer of a MOS structure due to Na/sup +/ impurities located in the oxide. The impurity potential is assumed unscreened. We take account of disorder to obtain the configurational averaged Green's function starting from a tight binding Hamiltonian.

10345 (INIS-BR—903, pp 339-343) **Resistivity of a disordered 2-D electron gas in terms of force-force correlation function.** Cunha Lima, I.C. da. (Instituto de Pesquisas Espaciais, Sao Jose dos Campos, Brazil). 1984. NTIS (US Sales Only), PC A12/MF A01. Order Number DE88700663/JAW. (CONF-8402101—).

From Simposio Latino-Am. de Fis. dos sistemas amorfos; Niteroi, Brazil (1 Feb 1984).

The lowest order diagram in a perturbative expansion of the force-force correlation function for a 2-D electron gas under strong magnetic field is used to calculate its resistivity.

10346 (INIS-BR—903, pp 344-350) **Zr contribution to the electronic transport of amorphous Cu 1-X ZrX.** Baibich, M.N. (Rio Grande do Sul Univ., Porto Alegre, Brazil. Inst. de Fisica). 1984. (In Portuguese). NTIS (US Sales Only), PC A12/MF A01. Order Number DE88700663/JAW. (CONF-8402101—).

From Simposio Latino-Am. de Fis. dos sistemas amorfos; Niteroi, Brazil (1 Feb 1984).

The r term of the thermoelectric power expression was calculated from experimental data for the electric resistivity of metal alloys in the extension of Faber-Ziman theory to metallic glasses. With this aim it was employed the scattering matrix formalism and the dependence of the energy of the phase displacements which are contained in it. The results are compared to the experimental data and a deviation with respect to composition is observed, although similarities found in liquid metal alloys. (M.W.O.).

10347 (INIS-BR—903, pp 351-357) **Local eletronic structure of TM-based alloys: a pulsed NMR study.** Aliaga G, D. (Universidad Nacional de Ingenieria, Lima, Peru). 1984. NTIS (US Sales Only), PC A12/MF A01. Order Number DE88700663/JAW. (CONF-8402101—).

From Simposio Latino-Am. de Fis. dos sistemas amorfos; Niteroi, Brazil (1 Feb 1984).

A pulsed NMR study on several transition metal + metalloid amorphous alloys is reported. The analysis of Knight shifts and nuclear spin-lattice relaxation times of metalloids indicates a dominant contribution of p- electrons in the Fermi level density od states, supporting the existence of p-d hibridization.

10348 (INIS-BR—903, pp 358-362) **Fermi surface relaxation effects in liquid metals.** Oliveira, F.A.; Ferraz, A. (Universidade Federal Fluminense, Niteroi, Brazil. Inst. de Fisica). 1984. NTIS (US Sales Only), PC A12/MF A01. Order Number DE88700663/JAW. (CONF-8402101—).

From Simposio Latino-Am. de Fis. dos sistemas amorfos; Niteroi, Brazil (1 Feb 1984).

The electron single particle occupation function for a liquid metal is calculated using the Bardeen's approximation. The results obtained indicate there is no discontinuity in that function at the Fermi level. (M.W.O.).

10349 (INIS-BR—903, pp 363-367) **Electric dipole ordering in the Alkali cyanides KCN and NaCN: short-range order effects.** Davidovich, M.A.; Koiller, B.; Brandi, H.S.; Luty, F. (Pontificia Univ. Catolica do Rio de Janeiro, Brazil. Dept. de Fisica; Utah Univ., Salt Lake City, USA. Dept. of Physics). 1984. NTIS (US Sales Only), PC A12/MF A01. Order Number DE88700663/JAW. (CONF-8402101—).

From Simposio Latino-Am. de Fis. dos sistemas amorfos; Niteroi, Brazil (1 Feb 1984).

The low temperature phases of the alkali cyanides KCN and NaCN are investigated. The Isisng Model with incorporation of pair correlations (Bethe approximation) is used to calculate the temperature dependence of the dieletric constant. The parameters of the model are obtained by adjusting its theoretical predictions to experimental values. This parametrization is used to calculate the temperature dependence of the specific heat. Our results are in good agreement with experimental data.

10350 (INIS-BR—903, pp 368-372) **Calculation of absorption coefficient of amorphous semiconductors in the MID infrared range.** Cisneros, J.I.; Bustarret, E.; Alvarez, F.; Chambouleyron, I.; Katiyar, R.S. (Universidade Federal Fluminense, Niteroi, Brazil. Inst. de Fisica). 1984. NTIS (US Sales Only), PC A12/MF A01. Order Number DE88700663/JAW. (CONF-8402101—).

From Simposio Latino-Am. de Fis. dos sistemas amorfos; Niteroi, Brazil (1 Feb 1984).

The purpose of this paper is to present a method for the calculation of the absorption coefficient of materials in thin film form using transmission data. The method was applied to the calculation of the absorption bands of a series of samples of hidrogenated silicon nitride. (M.W.O.).

10351 (INIS-BR—903, pp 381-384) **Theoretical model to the Raman spectrum of B/sub 2/O/sub 3/.** Barrio, R.A.; Galeener, F.L. (Universidad Nacional Autonoma de Mexico, Mexico City. Inst. de Investigaciones en Materiales; Xerox Palo Alto Research Center, CA, USA). 1984. NTIS (US Sales Only), PC A12/MF A01. Order Number DE88700663/JAW. (CONF-8402101—).

From Simposio Latino-Am. de Fis. dos sistemas amorfos; Niteroi, Brazil (1 Feb 1984).

In this paper we report a new theory that reproduces qualitatively well the Raman spectrum of v-B/sub 2/O/sub 3/. The basic idea is that one can find the thermodinamically averaged Green's function for a Bethe lattice, with a Born Hamiltonian, with dihedral angles totally random. In extension one constructs a Bethe lattice of rings and solve the equations of motion for Green's functions at the Boron sites, bridging oxygens and oxygens in the rings. (M.W.O.).

10352 (INIS-BR—903, pp 385-388) **Lattice dynamics of a- Si/sub 3/N/sub 4/.** Schulz, P.A.B.; Silva, C.E.T.G. da. (Universidade Estadual de Campinas, Brazil. Inst. de Fisica). 1984. (In Portuguese). NTIS (US Sales Only), PC A12/MF A01. Order Number DE88700663/JAW. (CONF-8402101—).

From Simposio Latino-Am. de Fis. dos sistemas amorfos; Niteroi, Brazil (1 Feb 1984).

We introduce a model for the lattice dynamics of SI/sub 3/N/sub 4/ in its amorphous phase. This model is based on a Born hamiltonian, solved in the Bethe lattice approximation. We included the local vicinity until third nearest neighbours, building up the central cluster. (M.W.O.).

10353 (INIS-BR—903, pp 389-392) **Surfaces effects in first order phase transition solid systems.** Mejia-lira, F.; Moran-Lopez, J.L.; Bennemann, K.H. (Universidad Autonoma de San Luis Potosi, Mexico; Instituto Politecnico Nacional, Mexico City. Centro de Investigacion y de Estudios Avanzados; Freie Univ. Berlin, Germany, F.R.). 1984. (In Spanish). NTIS (US Sales Only), PC A12/MF A01. Order Number DE88700663/JAW. (CONF-8402101—).

From Simposio Latino-Am. de Fis. dos sistemas amorfos; Niteroi, Brazil (1 Feb 1984).

A specific solid system with first order phase transition in its surface is analysed. To accomplish this task, we use the Landau theory. (M.W.O.).

10354 (INIS-BR—903, pp 393-396) **Interchange theory in the concentration profile on low irradiation bynary alloys surfacee.** Moran-Lopez, J.L.; Mejia-Lira, F. (Universidad Autonoma de San Luis Potosi, Mexico; Instituto Politecnico Nacional, Mexico City. Centro de Investigacion y de Estudios Avanzados). 1984. (In Spanish). NTIS (US Sales Only), PC A12/MF A01. Order Number DE88700663/JAW. (CONF-8402101—).

From Simposio Latino-Am. de Fis. dos sistemas amorfos; Niteroi, Brazil (1 Feb 1984).

The effect of vacancies in the concentration properties of a binary alloy A/sub x/ B/sub 1-x/ with random distribution of its atoms is considered. (M.W.O.).

10355 (INIS-BR—903, pp 397-400) **On the theory of elastic scattering of spin polarized electrons from ferromagnets.** Helman, J.S.; Baltensperger, W. (Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro; Theoretische Physik, ETH Hcenggerberg, Zurich, Switzerland). 1984. NTIS (US Sales Only), PC A12/MF A01. Order Number DE88700663/JAW. (CONF-8402101—).

From Simposio Latino-Am. de Fis. dos sistemas amorfos; Niteroi, Brazil (1 Feb 1984).

The first Born approximation supposedly inadequate for dealing with elastic scattering of spin polarized electrons on ferromagnets is reconsidered. It is found that when used in conjunction with a spin dependent pseudopotential, it can describe the gross features of the ansisotropy.

10356 (INIS-BR—903, pp 406-409) **Ferromagnetism and spatial ordering in FeCo alloys.** Martinez-Herrera, F.J; Mejia-Lira, F.; Aguilera-Granja, F.; Moran-Lopez, J.L. (Universidad Autonoma de San Luis Potosi, Mexico; Instituto Politecnico Nacional, Mexico City. Centro de Investigacion y de Estudios Avanzados). 1984. (In Spanish). NTIS (US Sales Only), PC A12/MF A01. Order Number DE88700663/JAW. (CONF-8402101—).

From Simposio Latino-Am. de Fis. dos sistemas amorfos; Niteroi, Brazil (1 Feb 1984).

In this letter is studied the correlation between magnetism and spatial ordering in the Bethe aproximation for a system with a body centered cttice. (M.W.O.).

10357 (INIS-BR—903, pp 410-414) **Order-disorder transitions in adsorbed systems on magnetic surfaces.** Aguilera-Granja, F.; Moran-Lopez, J.L.; Falicov, L.M. (Universidad Autonoma de San Luis Potosi, Mexico; Instituto Politecnico Nacional, Mexico City. Centro de Investigacion y de Estudios Avanzados; California Univ., Berkeley, USA. Dept. of Physics). 1984. (In Spanish). NTIS (US Sales Only), PC A12/MF A01. Order Number DE88700663/JAW. (CONF-8402101—).

From Simposio Latino-Am. de Fis. dos sistemas amorfos; Niteroi, Brazil (1 Feb 1984).

It is investigated the effect of adsorbed atoms on the magnetic properties of ferromagnets. The Ising model is employed considering nearest neigbours with antiferromagnetic coupling between atoms. (M.W.O.).

10358 (INIS-BR—903, pp 415-419) **On the validity of the alloy model to the magnetism in transition metals.** Linke, R; Bennemann, K.H.; Moran-Lopez, J.L. (Freie Univ., Berlin, Germany, F.R. Inst fuer Theoretische Physik; Universidad Autonoma San Luis Potosi, Mexico. Inst. de Fisica). 1984. (In Spanish). NTIS (US Sales Only), PC A12/MF A01. Order Number DE88700663/JAW. (CONF-8402101—).

From Simposio Latino-Am. de Fis. dos sistemas amorfos; Niteroi, Brazil (1 Feb 1984).

The magnetic properties of translation metal alloys are studied apllying the Hartree-Fock method and the Hubbard Hamiltonian. (M.W.O.).

10359 (INIS-BR—903, pp 420-423) **Ising model and its applications to a phase transition of biological interest.** Cabrera, G.G.; Stein-Barana, A.M.; Zuckermann, M.J. (Universidade Estadual de Campinas, Brazil. Inst. de Fisica; McGill Univ., Montreal, Quebec, Canada. Dept. of Physics). 1984. NTIS (US Sales Only), PC A12/MF A01. Order Number DE88700663/JAW. (CONF-8402101—).

From Simposio Latino-Am. de Fis. dos sistemas amorfos; Niteroi, Brazil (1 Feb 1984).

It is investigated a gel-liquid crystal phase transition employing a two-state model equivalent to the Spin 1/2 Ising Model with applied magnetic field. The model is studied from the standpoint of the cluster variational method of Kikuchi for cooperative phenomena. (M.W.O.).

10360 (INIS-BR—903, pp 425-429) **Least action principle of interacting dislocations in a molten solid.** Ferraz, A. (Universidade Federal Fluminense, Niteroi, Brazil. Inst. de Fisica). 1984. NTIS (US Sales Only), PC A12/MF A01. Order Number DE88700663/JAW. (CONF-8402101—).

From Simposio Latino-Am. de Fis. dos sistemas amorfos; Niteroi, Brazil (1 Feb 1984).

Using the action at a distance priciple it is derived the total classical action for interacting stationary closed dislocations which reproduces elasticity theory. (M.W.O.).

10361 (INIS-BR—903, pp 430-433) **Electronic and structural properties of the Mg/sub 75/Cu/sub 20/Sn/sub 5/ Metallic Glass.** Arcondo, B.; Nassif, E.; Quintana, G.; Sirkin, H.; Zardunaisky, D.; Kurlat, D. (Buenos Aires Univ. Nacional, Argentina. Facultad de Ingenieria). 1984. NTIS (US Sales Only), PC A12/MF A01. Order Number DE88700663/JAW. (CONF-8402101—).

From Simposio Latino-Am. de Fis. dos sistemas amorfos; Niteroi, Brazil (1 Feb 1984).

The total structure factor S(Q) of the Mg/sub 75/ Cu/sub 20/ Sn/sub 5/ amorphous alloy obtained by the 'melt-spinning' technique has been measured by means of X-ray diffraction. The magnetic susceptibility was also measured for those temperatures from which the melt was rapidly cooled to obtain the amorphous samples. (M.W.O.).

10362 (INIS-BR—903, pp 438-442) **Study of the crystallization of metallic glasses METGLAS 2826 and METGLAS 2826A by ferromagnetic resonance.** Biasi, R.S. de; Fernandes, A.A.R.; Rodrigues, R.W.D.; Pascual, R. (Instituto Militar de Engenharia, Rio de Janeiro, Brazil. Centro de Pesquisa de Materiais). 1984. (In Portuguese). NTIS (US Sales Only), PC A12/MF A01. Order Number DE88700663/JAW. (CONF-8402101—).

From Simposio Latino-Am. de Fis. dos sistemas amorfos; Niteroi, Brazil (1 Feb 1984).

Using ferromagnetic reaonance, it was investigated the crystalization of the METGLAS 2826 and METGLAS 2826A. The line width of the first derivative of the absorption curve was measured for several time intervals o isothermal treatment at 375/sup 0/C. It was observed that after a decrease, due to tension relaxation, the line width increases with the interval of time treatment. The resultus indicate that, for suficiently long in itervals of time. the line width is function of the transformed fractiononly.

10363 (INIS-BR—903, pp 443-448) **Crystallization of amorphous pseudobinary alloys of the type (Fe/sub 1-x/ Ni/sub x/)/sub 80/ B/sub 20/.** Vasconcellos, M.A.Z.; Baibich, M.N. (Rio Grande do Sul Univ., Porto Alegre, Brazil). 1984. (In Portuguese). NTIS (US Sales Only), PC A12/MF A01. Order Number DE88700663/JAW. (CONF-8402101—).

From Simposio Latino-Am. de Fis. dos sistemas amorfos; Niteroi, Brazil (1 Feb 1984).

It was studied the crystallization of amorphous metallic ribbons of Fe/sub 1-x/ Ni/sub x/ /sub 80/ B/sub 2/0 using the method of isochronous heating at variable slopes. The crystallization temperatures were determined from the transition observed in the electrical resistivity. (M.W.O.).

10364 (INIS-BR—904) **On the critical behaviour of the Ising model with mixed two-and three-spin interactions.** Alcaraz, F.C.; Barber, M.N. (Sao Carlos Univ., Brazil. Dept. de Fisica). (Sao Carlos Univ. (Brazil). Dept. de Fisica). 1986. 34p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88700873/JAW.

A two-dimensional Ising model with staggered three spin interactions in one direction and two spin interactions in the other one is presented and studied. The phase diagram of the model and its critical behaviour is explored by conventional finite size scaling and by exploiting relations between mass gap amplitudes and critical exponents predicted by conformal invariance. The model is found to exhibit a line of continuosly varying critical exponents which bifurcates into two Ising critical lines. This similarity of the model with the Ashkin-Teller model leads to a conjecture for the exact critical indices along the non-universal critical curve. Earlier contradictions about the universality class of the uniform (Isotropic) case of the model are clarified.

10365 (INIS-mf—11052) **International summer school on hyperfine interactions and physics with oriented nuclei - 1985. Pt. 1, 2.** Rotter, M. (ed.). (Karlova Univ., Prague (Czechoslovakia). Fakulta Matematicko-Fyzikalni). 1985. 428p. (CONF-8509430—). NTIS (US Sales Only), PC A19/MF A01. Order Number DE88700667/JAW.

From International summer school on hyperfine interactions and international study meeting: physics with oriented nuclei; Bechyne, Czechoslovakia (2 Sep 1985).

Part I and part II are presented of the contributions submitted to the International study meeting on physics with oriented nuclei and of papers from the International summer school on hyperfine interactions. The contributions and papers are devoted to the present status and further development of low temperature nuclear orientation of short-lived nuclei with emphasis on online techniques. The following topics are covered: nuclear orientation, NMR/ON, level mixing and level crossing resonances, laser spectroscopy, Moessbauer spectroscopy, polarization phenomena in low, medium and high energy physics, applications of hyperfine interaction techniques in nuclear physics, atomic physics, solid state physics, biology and materials research. (Z.J.).

10366 (INIS-mf—11052, pp vp) **Hyperfine interaction studies in rare-earth intermetallic compounds.** Devare, H.G. (Tata Inst. of Fundamental Research, Bombay, India). 1985. NTIS (US Sales Only), PC A19/MF A01. Order Number DE88700667/JAW. (CONF-8509430—).

From International summer school on hyperfine interactions and international study meeting: physics with oriented nuclei; Bechyne, Czechoslovakia (2 Sep 1985).

Several rare earth intermetallic compounds are studied using time differential perturbed angular correlation with /sup 111/Cd and Moessbauer studies with /sup 57/Fe and /sup 151/Eu probe nuclei. Interesting results are presented which clearly illustrate the various aspects involved in the application of these microscopic techniques in the study of problems in solid state physics. (Z.J.).

10367 (INIS-mf—11052, pp vp) **Hyperfine interactions of spin polarized β emitter /sup 12/N in ferromagnetic Fe crystal.** Minamisono, T.; Nojiri, Y.; Matsuta, K.; Fujinaga, M.; Iwayama, T. (Osaka Univ., Japan). 1985. NTIS (US Sales Only), PC A19/MF A01. Order Number DE88700667/JAW. (CONF-8509430—).

From International summer school on hyperfine interactions and international study meeting: physics with oriented nuclei; Bechyne, Czechoslovakia (2 Sep 1985).

Nuclear magnetic resonance spectra were obtained for /sup 12/N in single crystal Fe. The magnetic dipolar field was observed as well as the relatively weak magnetic hyperfine fields.

10368 (INIS-mf—11052, pp vp) **Hyperfine interactions of interstitial /sup 12/N impurity in V single crystal.** Minamisono, T.; Nojiri, Y.; Matsuta, K.; Fujinaga, M.; Iwayama, T. (Osaka Univ., Japan). 1985. NTIS (US Sales Only), PC A19/MF A01. Order Number DE88700667/JAW. (CONF-8509430—).

From International summer school on hyperfine interactions and international study meeting: physics with oriented nuclei; Bechyne, Czechoslovakia (2 Sep 1985).

NMR spectra of /sup 12/N in single crystal V (bcc) were studied. All /sup 12/N ions which maintained polarization were located on interstitial tetrahedral sites. Due to the impurity, the lattice of the nearest neighbour V was largely expanded.

10369 (INIS-mf—11052, pp vp) **Amorphous system investigation by the Moessbauer spectroscopy.** Sedykh, V.D. (AN SSSR, Moscow). 1985. NTIS (US Sales Only), PC A19/MF A01. Order Number DE88700667/JAW. (CONF-8509430—).

From International summer school on hyperfine interactions and international study meeting: physics with oriented nuclei; Bechyne, Czechoslovakia (2 Sep 1985).

It is shown that Moessbauer spectroscopy is a very powerful method for the study of metallic glasses and that it allows obtaining useful and versatile information on hyperfine interactions in such material. The physical properties are discussed of amorphous metallic materials. (Z.J.).

10370 (INIS-mf—11052, pp vp) **Non-standard Moessbauer experiments.** Zemcik, T. (Ceskoslovenska Akademie Ved, Brno. Ustav Fyzikalni Metalurgie). 1985. NTIS (US Sales Only), PC A19/MF A01. Order Number DE88700667/JAW. (CONF-8509430—).

From International summer school on hyperfine interactions and international study meeting: physics with oriented nuclei; Bechyne, Czechoslovakia (2 Sep 1985).

Some improvements in classical Moessbauer transmission and scattering experiments are described. In solid state applications, especially when studying non-crystalline structures, more information is needed than provided by the well-known velocity spectra of, e.g., /sup 57/Fe 14.4 keV gamma rays, and by their standard least-squares processing. New methods of detection (2π-backscattering, conversion electrons) are shown, the broadening of the range of physical conditions (micro-probes, high temperature scanning, use of gamma-ray polarization properties) is discussed, and the modern hyperfine field distribution approach shown.

10371 (INIS-mf—11052, pp vp) **Nuclear spin-lattice relaxation of /sup 60/Co in ferromagnetic alloy Pt/sub 99/Co/sub 1/ and Pd/sub 99/Co/sub 1/.** Trhlik, M.; Sedlak, B.; Rotter, M.; Lestak, L.; Pavlov, V.N.; Cizek, P.; Finger, M.; Erzinkyan, A.L.; Parfenova, V.P.; Gurevich, G.M. (Karlova Univ., Prague, Czechoslovakia. Fakulta Matematicko-Fyzikalni; Joint Inst. for Nuclear Research, Dubna, USSR; Moskovskij Gosudarstvennyj Univ., USSR; AN SSSR, Moscow. Inst. Yadernykh Issledovanij). 1985. NTIS (US Sales Only), PC A19/MF A01. Order Number DE88700667/JAW. (CONF-8509430—).

From International summer school on hyperfine interactions and international study meeting: physics with oriented nuclei; Bechyne, Czechoslovakia (2 Sep 1985).

10372 (INIS-mf—11052, pp vp) **NMR/ON and thermometric NMR in antiferromagnets.** Turrell, B.G.; Le Gros, M.; Kotlicki, A. (Walther-Meissner-Institut, Garching, Germany, F.R.; Victoria Univ., British Columbia, Canada. Dept. of Physics). 1985. NTIS (US Sales Only), PC A19/MF A01. Order Number DE88700667/JAW. (CONF-8509430—).

From International summer school on hyperfine interactions and international study meeting: physics with oriented nuclei; Bechyne, Czechoslovakia (2 Sep 1985).

10373 (INIS-mf—11052, pp vp) **Long-time heat release at low temperatures.** Kolac, M.; Neganov, B.S.; Sahling, A.; Sahling, S. (Joint Inst. for Nuclear Research, Dubna, USSR). 1985. NTIS (US Sales Only), PC A19/MF A01. Order Number DE88700667/JAW. (CONF-8509430—).

From International summer school on hyperfine interactions and international study meeting: physics with oriented nuclei; Bechyne, Czechoslovakia (2 Sep 1985).

10374 (INIS-mf—11054, pp 18) **SQUID measurements on optically induced magnetism. Nuclear spin cooling in Hg/sub 1-x/Mn/sub x/Te.** Kaltenegger, K.; Krenn, H. (Montanuniversitaet Leoben, Austria. Inst. fuer Physik). Sep 1987. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88700772/JAW. (CONF-8709196—).

From Annual convention fo the Austrian Physical Society; Vienna, Austria (21 Sep 1987).

10375 (INIS-mf—11054, pp 50) **Renormalization group theory and critical neutron scattering on isotropic ferromagnets at T>=T/sub c/.** Iro, H. (Johannes Kepler Univ., Linz, Austria). Sep 1987. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88700772/JAW. (CONF-8709196—).

From Annual convention fo the Austrian Physical Society; Vienna, Austria (21 Sep 1987).

10376 (ITEF—126-1986) **Ultracold neutrons in a magnetic trap. Experiment, estimations, possibilities.** Abov, Yu.G.; Belkin, V.F.; Belonozhenko, A.A. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1986. 15p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88700451/JAW.

Changes making in an experimental facility for ultracold neutron extraction from a reactor and for storage in a magnetic trap are described. The experimental results estimating the suppositions concerning the role of ultracold neutron resonance heating by low-frequency oscillations of a magnetic field and depolarization in field nodes are given. The upper estimation of the neutron quantity in a cycle storing for some time close to the life time is made. 9 refs.

10377 (JINR-R—3-86-779) **Slow neutron scattering by heavy water in the (23-200) deg C temperature range.** Lisichkin, Yu.V.; Novikov, A.G.; Fomichev, N.K.; Pehdureanu, I.; Rotareaku, G. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk. Fiziko-Ehnergeticheskij Inst.; Joint Inst. for Nuclear Research, Dubna, USSR. Lab. of Neutron Physics). (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Neutron Physics). 1986. 10p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88700919/JAW.

The result on heavy water investigation at 23; 130; 200 deg C temperatures using slow neutron inelastic scattering method are presented. The experimental equipment for neutron investigations of molecular dynamics of liquids in a wide range of temperature and pressure variation is described. Experimental double-differential cross sections of the slow neutron scattering by heavy water are transformed into the scattering law at Planck constantω=const and Q=const. The anomalous behaviour of the scattering law curves are noticed. 28 refs.; 7 figs.

10378 (KEK—86-10) **Future prospect of the research study using intense and bright synchrotron radiation in VUV and soft x-ray region.** Tanaka, Kenichiro; Miyahara, Tsuneaki (eds.). (National Lab. for High Energy Physics, Oho, Ibaraki (Japan)). Feb 1987. 198p. (In Japanese). NTIS (US Sales Only), PC A09/MF A01. Order Number DE88751074/JAW.

This report is the summary of the contents of the study meeting 'Future prospect of the research study using intense and bright synchrotron radiation in VUV and soft x-ray region' sponsored by PF, held on October 20 and 21, 1986. This study meeting was held by inviting those who are particularly interested in the basic field among the users of VUV and soft x-ray region, and the research on the application field was excluded. The objective of the discussion of this study meeting was to talk about the dream that if a high luminance light source which is 100 - 1000 times more intense in terms of luminous flux intensity is completed, what can we do with it. Three sessions on the themes 'How the existing research fields will develop', 'What the possible new research fields are' and 'Comment from the technical aspect' were held. More than seven years elapsed since the beginning of construction of the Photon Factory. Many excellent results have been obtained. As of October, 1986, the beam lines available for experiment are 11, the themes of common utilization experiment in progress are 300, and the number of registered researchers exceeded 1000. The development of a new light emission source is to be undertaken. (Kako, I.).

10379 **(LBL—23975) Studies of nonlinear and chaotic phenomena in solid state systems.** Bryant, P.H. (Lawrence Berkeley Lab., CA (USA)). Sep 1987. Contract AC03-76SF00098. 251p. NTIS, PC A12/MF A01; 1; GPO Dep. Order Number DE88002330/JAW.

This thesis contains three sections discussing different areas. Spin wave interactions in iron garnets are described in section one. Mathematical analysis of a magnetic oscillator is presented in section two. In the final section, the source of noise in Josephson Junctions is investigated. The three sections are indexed separately. (JDH)

10380 (LBL—23975, pp 1-110) **Part I: Spin wave dynamics in YIG spheres.** Sep 1987. NTIS, PC A12/MF A01. Order Number DE88002330/JAW.

In Studies of nonlinear and chaotic phenomena in solid state systems.

An experimental study is made of the interactions between spin wave modes excited in a sphere of yttrium iron garnet by pumping the Suhl subsidiary absorption with microwaves. The dynamical behavior of the magnetization is observed under high resolution by varying the dc field and microwave pump power. Varied behavior is found: (1) onset of the Suhl instability by excitation of a single spin wave mode; (2) when two or more modes are excited, interactions lead to auto-oscillations displaying period-doubling to chaos; (3) quasiperiodicity, locking, and chaos occur when three or more modes are excited; (4) abrupt transition to wide band power spectra (i.e., turbulence), with hysteresis; (5) irregular relaxation oscillations and aperiodic spiking behavior. A theoretical model is developed using the plane wave approximation obtaining the lowest order nonlinear interaction terms between the excited modes. Extension of this analysis to the true spherical spin-modes is discussed. Bifurcation behavior is examined, and dynamical behavior is numerically computed and compared to the experimental data. A theory is developed regarding the nature of the experimentally observed relaxation oscillations and spiking behavior based on the interaction of "weak" and "strong" modes, and this is demonstrated in the numerical simulations for two modes. Quasiperiodicity is shown to occur in the numerical study when at least 3 modes are excited with appropriate parameter values. A possible mechanism for generating microwave subharmonics at half of the pumping frequency is discussed. 57 refs., 25 figs., 5 tabs.

10381 **(LLB-RA—1985-86) Progress report 1985-1986.** (Laboratoire Leon Brillouin, Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). 1987. 275p. (In French). NTIS (US Sales Only), PC A12/MF A01. Order Number DE88751757/JAW.

From Diffraction group, studies of crystal and magnetic structure are presented, together with determination of preferential orientation in materials and with nuclear magnetism. From Dynamics group, studies on vibration dynamics around a phase transformation, on the molecular dynamics to precise interaction potential, on spin dynamics in one-dimensional compound are presented. The three domains of the non-commensurate phase laboratory studies are theoretical studies, - structure determination, - dynamics studies. The disordered solid studies are concerned with magnetic and chemical properties of crystal and amorphous systems. A chapter is given to liquids and glasses: the field of liquid studies is large including metals and semi-conductors, organic liquids and liquid crystals. In physico chemistry, structure and organization of finely divided matter; the works concern essentially, polymers and colloids. Surfaces studied by slow neutrons and surface and interfaces studies are also works presented. In instrumentation spectrometers and polarized neutrons have the first place.

10382 **(RAL—86-006) Critical spin dynamics of EuO.** Lovesey, S.W.; Williams, R.D. (Rutherford Appleton Lab., Chilton (UK)). Jan 1986. 10p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88750695/JAW.

The standard coupled-mode theory of spin dynamics is evaluated for an isotropic, Heisenberg model of EuO at the critical temperature. The predicted long wavelength limit of the spin relaxation function is approximately a gaussian function of time in the time interval probed in recent neutron spin echo measurements. This functional form is distinctly different from the observed, almost exponential, decay.

10383 **(RAL—86-018) Measurement of the velocity of sound in crystals by pulsed neutron diffraction.** Willis, B.T.M.; Carlile, C.J.; Ward, R.C.; David, W.I.F.; Johnson, M.W. (Rutherford Appleton Lab., Chilton (UK)). Mar 1986. 13p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88750689/JAW.

Submitted to Physical Review Letters.

The diffraction method of observing elementary excitations in crystals has been applied to the study of one-phonon thermal diffuse scattering from pyrolytic graphite on a high resolution pulsed neutron diffractometer. The variation of the phase velocity of sound as a function of direction in the crystal and efficient method of determining sound velocities in crystals under extreme conditions.

10384 **(RAL—86-043) SIMON: a simulation program for diffractometers on pulsed sources.** Howells, W.S. (Rutherford Appleton Lab., Chilton (UK)). May 1986. 15p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88750761/JAW.

Operating instructions are presented for the computer program SIMON which simulates the performance of a diffractometer on a pulsed neutron source.

10385 **(RAL—86-068) Initial results from the high resolution powder diffractometer HRPD at ISIS.** David, W.I.F.; Harrison, W.T.A.; Johnson, M.W. (Rutherford Appleton Lab., Chilton (UK)). Jul 1986. 13p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88750789/JAW.

The paper reviews the initial commissioning of the high resolution time-of-flight neutron powder diffractometer, HRPD, on the Spallation Neutron Source, ISIS, at the Rutherford Appleton Laboratory. Preliminary results have confirmed both intensity and resolution predictions indicating that ($\Delta d/d$) lies between 0.04% and 0.08% for all d-spacings between 0.2 and 5A. The scientific potential of this increased resolution over existing time-of-flight diffractometers has been demonstrated in the successful ab initio structure determination of an unknown inorganic material, $FeAsO_4$, and the detailed study of subtle symmetry changes in NiO. The true instrumental resolution, however, has been observed in only a small number of experiments: sample broadening is often seen to play a dominant role in the determination of the peak shape, particularly at longer d-spacings. This leads to additional useful information about macroscopic properties, such as anisotropic crystallite size, strain distribution and sample homogeneity, but also results in a significant increase in complexity of peak-shape description and data-analysis strategy.

10386 **(RAL—87-060) Solving crystal structures from neutron diffraction data.** Wilson, C.C. (Rutherford Appleton Lab., Chilton (UK)). Jul 1987. 12p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88751646/JAW.

In order to pursue crystal structure determination using neutron diffraction data, and given the wide experience available of solving structures using X-ray data, the codes used in X-ray structural analysis should be adapted to the different requirements of a neutron experiment. Modifications have been made to a direct methods program MITHRIL and to a Patterson methods program PATMET to incorporate into these the features of neutron rather than X-ray diffraction. While to date these modifications have been fairly straightforward and many sophistications remain to be exploited, results obtained from the neutron versions of both programs are promising.

6561 Superconductivity

REFER ALSO TO CITATION(S) 9059, 9065, 9084, 9086, 9090, 9091, 9092, 9093, 9095, 9096, 9099, 9101, 9110, 9111, 9112, 9113, 9114, 9115, 9116, 9120, 9122, 9151

10387 **(CONF-870802—30) Interpretation of the temperature dependence of conductivity in superconducting oxides.** Thorn, R.J. (Argonne National Lab., IL (USA)). 1987. Contract W-31109-ENG-38. 15p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88003028/JAW.

From 194. American Chemical Society national meeting; New Orleans, LA, USA (30 Aug 1987).

The diverse variations of the conductivities vs. temperature observed in oxide superconductors can be interpreted with a model based on microcanonical ensembles of a semiconductor and a semimetal originally derived for organic radical cation salts. The equation for the model transverses, through the variations of the Fermi and gap energies and a scattering factor, the range from a semiconductor to a semimetal and defines quantitatively the boundary between the two corresponding to the optimum superconducting state. Therein it describes quantitatively the roles of composition and pressure in determining the onset of the superconducting state. An examination of the published resistivity curves vs. temperature for La/sub 2-x/A/sub x/CuO/sub 4-δ/ and $YBa_2Cu_3O_{6.5+\delta}$ yield information consistent with the model and relevant to the defects and range of homogeneity needed for phase diagrams. 5 figs., 22 refs.

10388 (INIS-BR—901, pp 144-160) **Structural relaxation: low temperature properties.** Cruz, F. de la. (Centro Atomico Bariloche, Argentina). 1984. NTIS (US Sales Only), PC A12/MF A01. Order Number DE88700661/JAW. (CONF-8402101—).

From Simposio Latino-Am. de Fis. dos sistemas amorfos; Niteroi, Brazil (1 Feb 1984).

We discuss the changes in transport and superconducting properties of amorphous Zr/sub 70/Cu/sub 30/, induced by thermal relaxation. The experimental results are used to investigate the relation between the microscopic parameters and the observed physical properties. It is shown that the density of eletronic states determines the shift Tc as well as the variation of the electrical resistivity. It is necessary to assume strong hybridization between s and d bands to understand the eletrodynamic response of the superconductor.

10389 (INIS-BR—901, pp 161-175) **Amorphous superconductor.** Missell, F.P. (Sao Paulo Univ., Brazil. Inst. de Fisica). 1984. NTIS (US Sales Only), PC A12/MF A01. Order Number DE88700661/JAW. (CONF-8402101—).

From Simposio Latino-Am. de Fis. dos sistemas amorfos; Niteroi, Brazil (1 Feb 1984).

We describe briefly the strong cupling superconductivity observed in amorphous alloys based upon simple metals. For transition metal alloys we discuss the behavior of the superconducting transition temperature Tc, the upper critical field H/sub C2/ and the critical current J/sub C/. A survey of current problems is presented.

10390 (INIS-BR—901, pp 176-185) **On the superconductivity of vanadium based alloys.** Brouers, F.; Rest, J. Van der. (Freie Univ., Berlin, Germany, F.R. Inst. fuer Theoretische Physik; Liege Univ., Belgium. Inst. de Physique). 1984. NTIS (US Sales Only), PC A12/MF A01. Order Number DE88700661/JAW. (CONF-8402101—).

From Simposio Latino-Am. de Fis. dos sistemas amorfos; Niteroi, Brazil (1 Feb 1984).

The electron density of states of solid solutions of vanadium based transition metal alloys V/sub 90/ X/sub 10/ is computed with the aim of calculating the superconducting transition temperature using the McMillan formula. As observed experimentally for X on the left hand side of V in the periodic table, one obtains an increase of Tc while for X on the right hand side of V the critical temperature decreases. The detailed comparison with experiments indicate that when the bandwidths of the two constituents are different, one cannot neglect the variation of the electron-phonon interactions. Another important conclusion is that for alloys which are in the split-band limit like VAu, VPd and VPt, the agreement with experimental data can be obtained only by assuming that these alloys have a short-range order favouring clusters of pure vanadium.

10391 (LBL—24091) **High T/sub c/ superconductor as a strongly correlated state.** Kresin, V.Z. (Lawrence Berkeley Lab., CA (USA)). Aug 1987. Contract AC03-76SF00098. 5p. (CONF-870881—4). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88003194/JAW.

From 18. conference on superconductivity in highly correlated fermion systems; Sendai, Japan (31 Aug 1987).

A small value of the coherence length and the Fermi energy allows one to consider a new high T/sub c/ superconductor as a strongly correlated state. An analysis of the experimental data (La/sub 1.8/Sr/sub 0.2/CuO_4) leads to the conclusion that high T/sub c/ is provided by the coexistence of the phonon and non-phonon (plasmon) mechanisms of superconductivity. 20 refs.

10392 (RAL—87-064) **Correlation mediated superconductivity in a Spin Peierls Phase of the Hubbard Model.** Long, M.W. (Rutherford Appleton Lab., Chilton (UK)). Aug 1987. 13p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88751649/JAW.

The author explores the consequences of a mapping of the Hubbard Hamiltonian with a view to finding possible superconducting phases. The transformation pairs up all the sites and is therefore a much more natural starting point for describing a 'Spin Peierls' transition, generating enhanced singlet correlations for this pairing, than it is for describing the 'Resonating Valence Bond' state. It is shown that in the less than half filling case, an effective non-linear hopping Hamiltonian is quite useful in describing half of the electrons. This effective Hamiltonian can show a form of superconducting instability when nearest neighbour hopping is introduced to stabilise it. This superconducting phase seems to be a very unlikely possibility for the standard Hubbard model.

10393 (SAND—87-2668C) **Bulk superconductivity in La_2CuO_4.** Schirber, J.E.; Venturini, E.L.; Morosin, B.; Kwak, J.F.; Ginley, D.S.; Baughman, R.J. (Sandia National Labs., Albuquerque, NM (USA)). 1987. Contract AC04-76DP00789. 7p. (CONF-871124—6). NTIS, PC A02/MF A01; GPO Dep. Order Number DE88002509/JAW.

From Fall meeting of the Materials Research Society; Boston, MA, USA (30 Nov 1987).

In this paper we describe our studies of ceramic samples of La_2CuO_{4-y} loaded with oxygen by high pressure. This technique results in substantial incorporation of O_2 in the material (of the order of 0.3 to 0.4% by weight) and in gross changes in the bulk resistivity and magnetization as well as discernible changes in the lattice parameters of the material. 7 refs., 2 figs.

10394 **Superconducting T/sub c/ enhancement due to local phonon impurities.** Schuettler, H.B.; Jarrell, M.; Scalapino, D.J. (Argonne National Lab., IL). *Journal of Low Temperature Physics;* 69: No. 3-4, 159-165(Nov 1987). Contract W-31-109-ENG-38.

The authors have studied the enhancement of superconductivity due to a small concentration of local phonon impurities using a new method. The method combines diagrammatic perturbation theory and Monte Carlo simulation. This method allows us fully to take into account the retarded nature of the interactions and hence study in detail the interplay between the electron-phonon systems of the host and the impurities.

10395 **ESR in the superconducting phase of Gd-doped UBe_{13}.** Hijmans, T.W.; Taleb, S.; Clark, W.G.; Fisk, Z.; Smith, J.L.; Ott, H.R. (California Univ., Los Angeles, USA. Dept. of Physics; California Univ., Los Angeles, US. Solid State Science Center; Los Alamos National Lab., NM, USA; Eidgenoessische Technische Hochschule, Zurich, Switzerland. Lab. fuer Festkoerperphysik). *Solid State Communications;* 60: No. 4, 343-346(Oct 1986).

ESR measurements in UBe_{13} doped with 1000 ppm Gd are reported, at temperatures down to 0.4 K, which is well below the superconducting transition temperature of this heavy-Fermion system. The most important result is the observation that, within the experimental error, the Knight shift of the local Gd moments does not decrease below the normal-state value. The possible implications of this result for the nature of the superconductivity are discussed.

10396 Symmetry of superconducting compositions in the BaPbsub(1-x)Bisub(x)O$_3$system. Sleight, A.W.; Cox, D.E. (Du Pont de Nemours, E.I. and Co., Wilmington, DE, USA; Brookhaven National Lab., Upton, NY, USA). *Solid State Communications;* **58**: No. 6, 347-350(May 1986).

Reexamination of the symmetry of superconducting phases in the BaPbsub(1-x)Bisub(x)O$_3$ system was carried out by x-ray diffraction using a synchrotron source which offers exceptional resolution. These studies confirm our original finding of tetragonal symmetry. Confusion on the symmetry has resulted because some compositions in this system are two phase mixtures.

6570 Theoretical And Mathematical Physics

REFER ALSO TO CITATION(S) 9291, 9984, 10379

10397 (CBPF-NF—006/87) Gauge transformations in Dirac theory of constrained systems. Galvao, C.A.P.; Boechat, J.B.T. (Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro; PETROBRAS, Rio de Janeiro, Brazil). (Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro). 1987. 17p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88700838/JAW.

An analysis of some aspects of gauge transformations in the context of Dirac's theory of constrained systems is made. A generator for gauge transformations is constructed by comparing phase space trajectories with the same initial data but different choices of the arbitrary functions. An application to the Yang-Mills theory is performed. (L.C.).

10398 (CBPF-NF—009/87) Quantization of quadratic friction revisited. Sa Borges, J. de; Epele, L.N.; Fanchiotti, H.; Garcia C, C.A. (Rio de Janeiro Univ., Brazil. Inst. de Fisica; La Plata Univ. Nacional, Argentina. Dept. de Fisica). (Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro). 1987. 12p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88700839/JAW.

The quantization of a system subject to a friction force quadratic in the velocity and position dependent is carried out in the Feynman path integral framework. The resulting Hamiltonian coincides with the one obtained by using the Weyl-ordering canonical prescription.

10399 (IFT-S—01/86) Theories for the gravitational interaction. Aldrovandi, R. (Instituto de Fisica Teorica, Sao Paulo (Brazil)). 1986. 14p. (In Portuguese). (CONF-8609356—). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88700622/JAW.

From 7. national meeting on particles and fields physics; Caxembu, MG, Brazil (1 Sep 1986).

A short review on theories for the gravitational interactions is presented with emphasis in the gauge-like models.(L.C.).

10400 (IFVE-OTF—85-116) Potentials in N=2 supergravity. Zinov'ev, Yu.M. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1985. 7p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88700390/JAW.

Submitted to the journal Phys. Lett. B.

The potentials and Yukava interactions, that arise while introducing a gauge interaction of vector and scalar multiplets in N=2 supergravity are presented, in this the gauge group may be either compact or noncompact. The scalar multiplets geometry corresponds to nonlinear σ, models of the form Sp(2,2n)/Sp(2)xSp(2n), SU(2,n)/SU(2)SU(n)xU(1) and O(4,n)/O(4)xO(n). 6 refs.

10401 (IFVE-OTF—85-181) Gauge transformation in relativistic theory of gravity. Logunov, A.A.; Mestvirishvili, M.A. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1985. 20p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88700392/JAW.

Submitted to the journal Teor. Mat. Fiz. .

The paper contains a formulation of the gauge principle and a construction on its base of the Lagrangian density of the gravitational field. It is shown that Riemann space-time geometry is defined unabigously only in the presence of matter. In virtue of the gauge arbitrariness, Riemann space-time geometry could not in principle be fixed by gravitational fields only. 3 refs.

10402 (IFVE-OTF—85-183) Effect of radio signal delay in relativistic theory of gravity. Logunov, A.A.; Loskutov, Yu.M. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1985. 8p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88700393/JAW.

In the framework of the relativistic theory of gravity the expression for the radio signal delay time in the gravitational field has been obtained. When the Mercury, being in the superior conjuction with the Earth, is the radio signal reflector, the radio signal delay is shown to exceed the corresponding delay, predicted by the GTR by about 20 μs. 4 refs.

10403 (IFVE-OTF—85-187) Planet's satellite orbital motion period in the relativistic theory of gravity and in the GRT and possibility for experimental test of delay in gravitational field. Logunov, A.A.; Loskutov, Yu.M. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1985. 9p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88700395/JAW.

In the framework of the relativistic theory of gravity and the GRT the orbital motion period of a planet's sattelite has been obtained. There is a possibility for the experimental test of the difference between theoretical predictions. 12 refs.

10404 (IFVE-OTF—86-39) Quantum R matrices and matrix generalization of trigonometric functions. Bazhanov, V.V. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1986. 9p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88700868/JAW.

Submitted to the journal Theor. Math. Phys. .

The representations in terms of ratios of entire (quasi) periodic matrix functions have been obtained for trigonometric R-matrices related to the classical Lie algebras. The unitarity of R-matrices for these representations can be easily verified. 12 refs.; 2 tabs.

10405 (IFVE-OTF—86-85) Freund-Rubin type solutions for different compactifications of the eleven-dimensional space. Demichev, A.P.; Rodionov, A.Ya. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1986. 15p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88700869/JAW.

Submitted to the journal Sov. J. Nucl. Phys. .

The results of calculating geometrical characteristics of seven-dimensional quotient spaces are represented. These quantities are necessary for the construction of compactifying solutions of the eleven-dimensional supergravity. 12 refs.; 7 tabs.

10406 (IFVE-OTF—86-190) Hamiltonian approach to relativistic theory of gravity and to general relativity theory. Solov'ev, V.O. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1986. 40p. (In Russian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88700404/JAW.

The basic points of the canonical formalism of relativistic theory of gravity (RTG) and general relativity theory (GRT) are presented. The required preliminary information from the theory of constrained systems and the hypersurfaces geometry are given. The presence of the Minkowsky space in the RTG is shown to be the fundamental difference between the RTG and GRT. It allows one to speak about the localization of the energy-momentum of the gravitational field in this theory. 21 refs.

10407 **(IFVE-OTF—86-206) Integrable quantum systems and classical Lie algebras.** Bazhanov, V.V. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1986. 56p. (In Russian). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88700872/JAW.

Submitted to the journal Comm. Math. Phys. .

Six new infinite series of trigonometric solutions to triangle equations (quantum R-matrices) associated with the nonexceptional simple Lie algebras: sl(N), sp(N), o(N) have been obtained. R-matrices are given in two equivalent representations: in an additive one (as a sum of poles with matrix coefficients) and in a multiplicative one (as a ratio of entire matrix functions). These R-matrices provide an exact integrability of anisotropic generalizations of sl(N), sp(N), o(N) invariant one-dimensional lattice magnetics and two-dimensional periodic Toda lattices associated with the above algebras. 43 refs.; 3 tabs.

10408 **(INIS-mf—11054, pp 38) Extended inversion schemes of Bargmann type for the solution of the inverse scattering problem at fixed energy.** Leeb, H. (Technische Univ., Vienna, Austria). Sep 1987. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88700772/JAW. (CONF-8709196—).

From Annual convention fo the Austrian Physical Society; Vienna, Austria (21 Sep 1987).

10409 **(INIS-mf—11054, pp 71) Supersymmetric quantum mechanics.** Grosse, H.; Pittner, L. (Graz Univ., Austria. Inst. fuer Theoretische Physik; Vienna Univ., Austria. Inst. fuer Theoretische Physik). Sep 1987. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88700772/JAW. (CONF-8709196—).

From Annual convention fo the Austrian Physical Society; Vienna, Austria (21 Sep 1987).

10410 **(INIS-mf—11054, pp 72) Restriction of the nonuniqueness of the inverse scattering problem at fixed energy.** Hubner, E.; Leeb, H. (Technische Univ., Vienna, Austria). Sep 1987. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88700772/JAW. (CONF-8709196—).

From Annual convention fo the Austrian Physical Society; Vienna, Austria (21 Sep 1987).

10411 **(INIS-mf—11054, pp 12) Neutrons as test objects for quantum mechanics.** Rauch, H. (Atominstitut der Oesterreichischen Universitaeten, Vienna). Sep 1987. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88700772/JAW. (CONF-8709196—).

From Annual convention fo the Austrian Physical Society; Vienna, Austria (21 Sep 1987).

10412 **(ITEF—178-1985) Classical mechanics and 1/n expansion.** Popov, V.S.; Vajnberg, V.M.; Mur, V.D. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1985. 20p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88700452/JAW.

Classical approximation (n,l -> ∞) and 1/n expansion for quantum mechanics problems are considered. The recurrent method of calculation of members of a sequence of 1/n expansion for energy and wave functions (both for real and quasistationary states) is described. These results are considered by an example of the Yukawa, Hulthen, cone, etc. potentials. For potentials considred already two-three memebers of 1/n expansion determine the energy levels with 0.1% accuracy (even for small quantum numbers). 16 refs.; 3 figs.; 4 tabs.

10413 **(ITEF—152(1986)) Einstein-Kachler metrics on holomorphic vector bundles.** Alekseevskij, D.V.; Perelomov, A.M. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1986. 6p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88700895/JAW.

Explicitly Einstein-Kachler metrics on some holomorphic vector bundles over Hodge manifolds are determined. 2 refs.

10414 **(ITEP—158(1986)) Metastable vacuum decay at almost critical energy differences.** Selivanov, K.G. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1986. 11p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88700896/JAW.

Metastable vacuum decay in the case of large (almost critical) energy differences is considered. It is shown that at such differences the parametrical dependence of the decay rate can be found analitically and numerical coefficients can be computed for arbitrary number of space-time dimensions. The calculations are performed in a physically interesting two-dimensional case, when the problem of metastable vacuum decay is equivalent to the one of dislocation movement in presence of external tension. 10 refs.; 2 figs.

10415 **(ITEP—169-1986) On exact solutions of multidimensional Schroedinger equation with polynomial potentials.** Turbiner, A.V.; Uahveridze, A.G. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1986. 8p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88700460/JAW.

Three classes of exact solutions for the discrete spectrum of the two-dimensional Schroedinger equation with special polynomial potentials are constructed. Various types of the node surfaces in wave functions are found. It is shown that there are some node surfaces which do not change under variations of the asymmetry parameter of the potential. Multidimensional case is discussed in brief. 7 refs.; 1 fig.

10416 **(JINR—E-2-86-746) Mathematical models for quantum point contact spectroscopy.** Exner, P.; Seba, P. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1986. 14p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88700484/JAW.

Two mathematical models intended to describe the point contact spectroscopical experiments are constructed. It adds a new item to the list of recently discovered applications of the self-adjoint extension theory. 17 refs.; 9 figs.

10417 **(JINR—E-2-86-808) Dirac eigenvalues near upper and lower continuum.** Seba, P. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1986. 20p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88700486/JAW.

Recent interest in external field problem led us to investigate the behaviour of eigenvalues of the Dirac operator near the upper and lower continuum. The connection with the spontaneous positron production in superstrong external fields is also discussed. 58 refs.; 2 figs.

10418 **(JINR—E-4-86-584) Hamiltonian theories quantization based on a probability operator.** Entral'go, E.E.; Kuryshkin, V.V.; Zaparovannyj, Yu.I. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1986. 28p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88700488/JAW.

Submitted to the Quantum Mechanics Versus Local Realism - Einstein, Podolsky, and Rosen Paradox, PLENUM Book.

The quantization method with a linear reflection of classical coordinate-momentum-time functions A(q,p,t) at quantum operators in a space of quantum states psi, is considered. The probability operator satisfies a system of equations representing the principles of dynamical and canonical correspondences between the classical and quantum theories. The quantization based on a probability operator leads to a quantum theory with a nonnegative joint coordinate-momentum distribution function for any state psi. The main consequences of quantum mechanics with a probability operator are discussed in comparison with the generally accepted quantum and classical theories. It is shown that a probability operator leads to an appearance of some new notions called "subquantum" ones. Hence

the quantum theory with a probability operator does not pretend to any complete description of physical reality in terms of classical variables and by this reason contains no problems like Einstein-Podolsky-Rosen paradox. The results of some concrete problems are given: a free particle, a harmonic oscillator, an electron in the Coulomb field. These results give hope on the possibility of an experimental verification of the quantization based on a probability operator. 45 refs.

10419 **(JINR—E-5-86-713) Core spline method for solution of quantum-mechanical systems of differential equations for bound states.** Aleksandrov, L.; Drenska, M.; Karadzhov, D. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1986. 14p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88700492/JAW.

A generalization of the core spline method is given in the case of solution of the general bound state problem for a system of M linear differential equations with coefficients depending on the spectral parameter. The recursion scheme for construction of basic splines is described. The wave functions are expressed as linear combinations of basic splines, which are approximate partial solutions of the system. The spectral parameter (the eigenvalue) is determined from the condition for existence of a nontrivial solution of a (MxM) linear algebraic system at the last collocation point. The nontrivial solutions of this system determine (M - 1) coefficients of the linear spans, expressing the wave functions. The last unknown coefficient is determined from a boundary (or normalization) condition for the system. The computational aspects of the method are discussed, in particular, its concrete algorithmic realization used in the RODSOL program. The numerical solution of the Dirac system for the bound states of a hydrogen atom is given is an example. 10 refs.; 1 fig.; 2 tabs.

10420 **(JINR-E—17-85-945) Exact results in the problem of interaction of a two-level atom with radiation.** Kochetov, E.A. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1985. 5p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88700907/JAW.

Submitted to the journal Dokl. Akad. Nauk SSSR.

The Jaynes-Cummings model describing interaction of a two-level system with a radiation field is generalized to the case of interaction, nonlinear in bosonic variables. Exact wave functions and energy levels are found for the corresponding Hamiltonians. 4 refs.

10421 **(JINR-R—4-87-8) Schroedinger equation for the three-body problem in hyperspherical coordinates.** Vinitskij, S.I.; Kaschiev, M.S.; Puzynin, I.V. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Computing Techniques and Automation). 1987. 10p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88700920/JAW.

The spectral problem is formulated for a quantum-mechanical system of three Coulomb particles with a total angular momentum J. The problem included a system of (J+1) differential equations in a three-dimensional space and boundary conditions corresponding to the constraint on the wave function being finite throughout the whole space. For the problem, a variational functional of the Rayleigh-Ritz type is constructed in hyperspherical coordinates. This formulation is aimed at creating effective variation-difference schemes for calculating physical characteristics of three-particle systems. 11 refs.; 2 figs.

10422 **(JINR-R—5-86-667) On the Friedrichs model with nondiagonal singularity.** Bordag, L.A.; Matveev, V.B. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Computing Techniques and Automation). 1986. 7p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88700921/JAW.

Submitted to the journal Lett. Math. Phys. .

The Friedrichs model, i.e. a pair of operators H/sub 0/ and H=H/sub 0/+V, where H/sub 0/ and H are the free and perturbated Schroedinger operators respectively have been investigated. The perturbation V is an integral operator with nondiagonal singularity. A convenient intertwining operator T is constructed and the existence and completeness of the generalized wave operators are proved. 10 refs.

10423 **(JINR-R—5-86-833) Method of reduction of polynomially nonlinear equations to linear equations.** Yamaleev, R.M. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Computing Techniques and Automation). 1986. 15p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88700922/JAW.

Using the method of matrix linearization of polynomially nonlinear equation system a system of linear nonhomogeneous matrix equations is compared. Solutions of linear equations-accompanying matrices - are general solutions of original nonlinear problem in matrix representation. The algorithm of constructing the structure of basic vector and matrix-coefficients of linear system is given. A method for separating unknowns in polynomially nonlinear problem is expounded. The algorithm of construction of basic vector and unitary matrix, the columns of which consist of eigenvectors, in the method of linearization of quadratic equations by means of the Clifford algebra is proposed. The concepts of matrix differential and matrix derivative for multidimensional function are introduced. 7 refs.

10424 **(JINR-R—17-85-742) Introduction to quantum integrable systems. The R-matrix method.** Vladimirov, A.A. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1985. 39p. (In Russian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88700931/JAW.

Lectures for young scientists.

An elementary introduction to the quantum inverse scattering method (the R-matrix method) is given in. Essential algebraic structures of the method are explained in detail. 32 refs.

10425 **(LAPP-TH—194-87) Coupling the antisymmetric tensor to the supergravity-matter system.** Binetruy, P.; Girardi, G.; Grim, R.; Mueller, M. (Grenoble Univ., 74 - Annecy-le-Vieux, France. Lapp; Karlsruhe Univ., Germany, F.R.; CERN, Geneva, Switzerland). (Grenoble-1 Univ., 74 - Annecy (France). Lab. de Physique des Particules). Jun 1987. 13p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88751638/JAW.

The description of the antisymmetric tensor gauge field with Chern-Simons forms in Kaehler superspace is used to derive a particular coupling of the antisymmetric tensor to the general supergravity-matter system in terms of superfields as well as component fields. The construction is performed directly in terms of the linear multiplet. The proper duality transformations are presented at the full superfield level. General couplings are shortly discussed.

10426 (LBL—23975, pp 111-190) **Part 2: Dynamics of magnetic oscillator.** Sep 1987. NTIS, PC A12/MF A01. Order Number DE88002330/JAW.

In Studies of nonlinear and chaotic phenomena in solid state systems.

This is an experimental study of a forced symmetric oscillator containing a saturable inductor with magnetic hysteresis. It displays a Hopf bifurcation to quasiperiodicity, entrainment horns, and chaos. The bifurcations and hysteresis occurring near points of resonance (particularly "strong resonance") are studied in detail and it is shown how the observed behavior can be understood using Arnold's theory. Much of the behavior relating to the entrainment horns is explored: period doubling and symmetry breaking bifurcations; homoclinic bifurcations; and crises and other bifurcations taking place at the horn boundaries. Important features of the behavior related to symmetry properties of the oscillator are studied and explained through the concept of a half-cycle map. The system is shown to exhibit a Hopf bifurcation from a phase-locked state to periodic "islands," similar to those found in Hamiltonian systems. An initialization technique is used to observe the manifolds of saddle orbits and other hidden structure. An unusual differential equation model is developed which is irreversible and generates a noninvertible Poincare map of the plane. Noninvertibility of this planar map has important effects on the behavior observed. The Poincare map may also be approximated through experimental measurements, resulting in a planar map with parameter depend-

ence. This model gives good correspondence with the system in a region of the parameter space. 31 refs., 36 figs., 1 tab.

10427 (PPPL—2475) Numerical method for estimating the size of chaotic regions of phase space. Henyey, F.S.; Pomphrey, N. (La Jolla Inst., CA (USA). Center for Studies of Nonlinear Dynamics; Princeton Univ., NJ (USA). Plasma Physics Lab.). Oct 1987. Contract AC02-76CH03073. 29p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88003460/JAW.

A numerical method for estimating irregular volumes of phase space is derived. The estimate weights the irregular area on a surface of section with the average return time to the section. We illustrate the method by application to the stadium and oval billiard systems and also apply the method to the continuous Henon-Heiles system. 15 refs., 10 figs. (LSP)

10428 (RRK—87-11) Path integration on the upper half-plane. Kubo, Reijiro. (Hiroshima Univ., Takehara (Japan). Research Inst. for Theoretical Physics). Jun 1987. 8p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88751050/JAW.

Feynman's path integral is considered on the Poincare upper half-plane. It is shown that the fundamental solution to the heat equation $\delta f/\delta t = \Delta/\text{sub } H/f$ can be expressed in terms of a path integral. A simple relation between the path integral and the Selberg trace formula is discussed briefly.

70 FUSION ENERGY

REFER ALSO TO CITATION(S) 10175

10429 (INIS-mf—11054, pp 12) **What can a physicist contribute to the plasma technology?.** Uhlenbusch, J. (Duesseldorf Univ., Germany, F.R.). Sep 1987. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88700772/JAW. (CONF-8709196—).

From Annual convention fo the Austrian Physical Society; Vienna, Austria (21 Sep 1987).

7001 Plasma Research

REFER ALSO TO CITATION(S) 10020, 10030, 10427, 10525, 10540, 10567, 10589, 10591, 10639

10430 (EUR-CEA-FC—1328) Highly ionized xenon spectra (95-260 Angstroms) excited in TFR Tokamak plasmas. Breton, C.; Demichelis, C.; Hecq, W.; Mattioli, M.; Ramette, J.; Saoutic, B.; Bauche-Arnoult, C.; Bauche, J.; Wyart, J.F. (Dept de Recherches sur la Fusion Controlee, Association Euratom CEA CEN-Cadarache, 13-Saint-Paul-Lez-Durance, France; Laboratoire Aime-Cotton 91-Orsay, France). (Association Euratom-CEA, Centre d'Etudes Nucleaires de Cadarache, 13 - Saint-Paul-lez-Durance (France). Dept. de Recherches sur la Fusion Controlee). Jun 1987. 20p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88751604/JAW.

The Xe spectrum in the 95-260 Angstroms spectral region, excited in TFR Tokamak plasmas, has been recorded by a grazing incidence multichannel spectrometer. Several lines in the Cu- and Zn-like isoelectronic sequences as well as a broad band (due to the superposition of unresolved transition arrays strongly mixed by configuration interaction) have been identified.

10431 (EUR-CEA-FC—1329) Current drive by EC and LH waves in Tore Supra for steady-state reactor studies. Fidone, I. (Association Euratom-CEA, Centre d'Etudes Nucleaires de Cadarache, 13 - Saint-Paul-lez-Durance (France). Dept. de Recherches sur la Fusion Controlee). Jun 1987. 50p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88751605/JAW.

A long term ECRH program in TORE SUPRA for current drive researches is proposed. The aim of the program is twofold, namely, optimization of the rf driven current in TS by an appropriate combination of LH and EC waves and the search of current drive scenarii of relevance for the steady-state reactor. It is shown that under favourable conditions, steady-state operation can be envisioned by rf current drive with a marginally acceptable efficiency. Experimental results on selective wave absorption at down shifted frequency obtained in PLT and on current drive by EC and LH wave in WT-2 and JFT-2M are given besides the studies presented on Tore Supra.

10432 (FED/VU—87-210) The connection between theoretical transport mechanisms and ohmic, L and H mode tokamak behavior. Sheffield, J. (Oak Ridge National Lab., TN (USA)). 1987. Contract AC05-84OR21400. 24p. (CONF-871185—1-Vugraphs). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88002605/JAW.

From H-mode workshop; San Diego, CA, USA (9 Nov 1987).

10433 (IAE—4301/6) Determination of electron thermal conductivity coefficient using thermal wave characteristics during ecr heating. Dnestrovskij, Yu.N.; Neudachin, S.V. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii). 1986. 15p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88700849/JAW.

Possibility of determining electron thermal conductivity by thermal wave propagation at the beginning of ecr-heating in a tokamak is investigated. It is shown, that under heating with sufficiently sharp edges of absorbed SHF-power profile electron temperature increment relation in the points near the heating zone edge appears to be just a self-model function of a single argument. This allows one to derive an analytical formula for determining the local thermal diffusivity a series of numerical calculations has confirmed the correctness of the analytical formula and allowed one to determine the optimal region of measurements. 3 refs.; 6 figs.; 1 tab.

10434 (IAE—4312/7) Measuring energy confimenet time in the T-13 tokamak with variable major radius of plasma filament. Abramov, A.V.; Belashov, V.I.; Bortnikov, A.V. and others. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii). 1986. 31p. (In Russian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88700850/JAW.

Method for determining the energy confinement time in the plasma filament electron component in the T-13 tokamak is considered. Determination techniques are described and experimental results, concerning the measurement of plasma filament geometric parameters, plasma density, electron temperature by X radiation using filter technique and by plasma conductivity, energy losses due to radiation and diffusion, energy life-time are presented. The role of accelerated electrons in plasma energy balance and current drift is estimated. 23 refs.; 24 figs.

10435 (IAE—4340/7) Using laser-induced fluorescence spectroscopy method for investigating iron atom behaviour on the TO-2 tokamak plasma filament periphery. Artemenkov, L.I.; Vukolov, K.Yu.; Mukhin, P.A. and others. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii). 1986. 15p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88700853/JAW.

Theoretical prerequisites and methods for laser fluorescent spectroscopy (LFS) to measure heavy impurity concentration in a tokamak with TO-2 diverter are described with the purpose of organizing plasma diagnostics in the T-15 tokamak. Results of measuring iron atom absolute concentrations during discharge in the TO-2 tokamak near-the well area by LFS method are presented. Preliminary experiments on detecting channel absolute calibration by the fluorescent signal of a tube with a hollow cathode, pumped by probing laser radiation are conducted. 15 refs.; 6 figs.

10436 **(IAE—4357/6) Plasma rotation in a tokamak.** Morozov, D.Kh.; Yushmanov, P.N. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii). 1986. 20p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88700855/JAW.

Review of modern state of neoclassical theory, concerning plasma rotation in a tokamak at minor rates (as compared to the thermal one) is given. The prevailing style of the work is the hydrodynamic one, which allows one to trace the conservation laws and the relationship between toroidal pulse relaxation and plasma diffusion processes. Kinetic coefficients are calculated using simple gaseous-kinetic estimations and their values, obtained from kinetic equation solution, are given as references. Results of neoclassical theory for plasma rotation at high rates are briefly presented. The role of anomalous processes is also considered. 20 refs.

10437 **(IAE—4369/6) Ionization equilibrium and radiative energy losses in a stationary plasma.** Fedulov, M.V. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii). 1986. 24p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88700856/JAW.

Calculational model for determining ionization equilibrium, energy level population density and radiative energy losses from a high-temperature homogeneous stationary plasma is descirbed. Calculational results for optically transparent plasma and under final characteristic dimensions of region, occupied by plasma, are presented. The model allows one to perform calculations for plasma, containing ions with the electron number, which does not exceed 10-12. 23 refs.; 7 figs.

10438 **(IAE—4373/14) Laser pulse detection with infrared range semiconductor detectors.** Zhukovskij, V.G.; Rtishchev, V.A. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii). 1986. 20p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88700857/JAW.

Method for registering short (~ 150 ns), low power (~ 10/ sup -7/ W), 10.6 μm wave length pulses of radiation is investigated. Duration and power calibrated radiation pulses were formed by electrooptical modulator from the continuous CO/sub 2/-laser radiation. Detecting system included cooled high-ohmic fast responce photodetector Si:B and a charge-sensitive amplifier. It is shown, that the minimum detectable radiation energy makes up ~ 3.10/sup -15/ J. Comparison of pukse detection efficiency to the detection efficiency of pulse scattering on ruby laser radiation plasma shows, that the detection method described may be applied in diagnostics of multipulse Thomson scattering in CO/sub 2/-laser for measuring the plasma electron temperature in tokamaks. 8 refs.; 12 figs.

10439 (INIS-mf—11054, pp 32) **Low-frequency radiowave heating of toroidal fusion plasmas.** Cap, F.F. (Innsbruck Univ., Austria. Inst. fuer Theoretische Physik). Sep 1987. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88700772/JAW. (CONF-8709196—).

From Annual convention fo the Austrian Physical Society; Vienna, Austria (21 Sep 1987).

10440 (INIS-mf—11054, pp 31) **Detection of impurity ions in Tokamak boundary-layer plasmas by Lithium-ion-beam activated charge exchange spectroscopy.** Aumayr, F.; Winter, H. (Technische Univ., Vienna, Austria. Inst. fuer Allgemeine Physik). Sep 1987. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88700772/JAW. (CONF-8709196—).

From Annual convention fo the Austrian Physical Society; Vienna, Austria (21 Sep 1987).

10441 (INIS-mf—11054, pp 31) **Coulomb interaction in a magnetised plasma.** Hensler, E. (Max-Planck-Institut fuer Plasmaphysik, Garching/Muenchen, Germany, F.R. Informatik). Sep 1987. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88700772/JAW. (CONF-8709196—).

From Annual convention fo the Austrian Physical Society; Vienna, Austria (21 Sep 1987).

10442 (INIS-mf—11054, pp 33) **Neutron birth rate from dd reactions caused by fast deuterons slowing down in a d-plasma.** Riedler, J.M. (Max-Planck-Institut fuer Plasmaphysik, Garching/Muenchen, Germany, F.R. Informatik). Sep 1987. NTIS (US Sales Only), PC A05/MF A01. Order Number DE88700772/JAW. (CONF-8709196—).

From Annual convention fo the Austrian Physical Society; Vienna, Austria (21 Sep 1987).

10443 (INIS-mf—11054, pp 33) **Effects of reaction products in fusion plasmas.** Schoepf, K.; Heinrichs, G. (Innsbruck Univ., Austria. Inst. fuer Theoretische Physik; Technische Univ., Graz, Austria. Inst. fuer Theoretische Physik und Reaktorphysik). Sep 1987. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88700772/JAW. (CONF-8709196—).

From Annual convention fo the Austrian Physical Society; Vienna, Austria (21 Sep 1987).

10444 (INIS-mf—11054, pp 34) **Transport phenomena in degenerate plasmas.** Kamelander, G. (Oesterreichisches Forschungszentrum Seibersdorf G.m.b.H. Inst. fuer Reaktorsicherheit). Sep 1987. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88700772/JAW. (CONF-8709196—).

From Annual convention fo the Austrian Physical Society; Vienna, Austria (21 Sep 1987).

10445 **(JAERI-M—87-103) Development of tokamak reactor system analysis code 'NEW-TORSAC'.** Kasai, Masao; Ida, Toshio; Nishikawa, Masana; Kameari, Akihisa; Nishio, Satoshi; Tone, Tatsuzo. (Japan Atomic Energy Research Inst., Tokyo). Jul 1987. 38p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88751067/JAW.

Systems analysis code named NEW-TORSAC (TOkamak Reactor Systems Analysis Code) has been developed by modifying the TORSAC which had been already developed by us. The NEW-TORSAC is available for tokamak reactor designs and evaluations from experimental machines to commercial reactor plants. It has functions to design tokamaks automatically from plasma parameter setting to determining configurations of reactor equipments and calculate main characteristics parameters of auxiliary systems and the capital costs. In the case of analyzing tokamak reactor plants, the code can calculate busbar energy costs. Some output of this code such as a reactor configuration, plasma equilibrium, electro-magnetic forces, etc. are graphically displayed as well as numerical output. The code has been successfully applied to the scoping studies of the next generation machines and commercial reactor plants.

10446 **(JET-R—86-04) Integrated analysis of data from JET.** Christiansen, J.P. (Commission of the European Communities, Abingdon (UK). JET Joint Undertaking). 1986. 52p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE88750694/JAW.

A description is given of the present and past methods used for interpreting JET data. It is shown how the raw data acquired after each plasma pulse are processed by a variety of calculations which store their results in data banks. Individual sections deal with data from a particular JET diagnostic and other sections describe calculations using that data. In many cases such calculations may require data from more than one diagnostic. At the end of each section a table displays the names and symbols associated with the data and results. Finally a table summarises the processing of data.

10447 **(JET-R—87-04) Some aspects of operational reliability of the JET central interlock and safety system (CISS) in the period March 1984 to December 1986.** Montfoort, Joop van. (Commission of the European Communities, Abingdon (UK). JET Joint Undertaking). 1987. 15p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88751641/JAW.

The Central Interlock and Safety System (CISS) provides basic safety functions for the JET plant. It monitors the status of emergency push buttons, access doors and plant equipment and takes corrective shutdown actions in the case that plant conditions are not compatible with safe operation. CISS consists of a hierarchical network of PLCs (programmable logic controllers) paralleling the CODAS architecture. It has been successfully in operation since June 1983 and has intervened many times and halted operation to protect JET from (further) damage or personnel against danger. The note will analyse genuine CISS failures only, and as will be shown, these failures are all due to malfunctioning of PLC hardware. All CISS failures have failed-safe and resulted in the expected shutdown action. Hence CISS failures have never resulted in a dangerous situation but they have restricted operational availability of JET.

10448 (LA—11139-C, pp 1-16) **RFP physics and RFX characteristics and objectives.** Ortolani, S. (EURATOM-ENEA-CNR Association, Padova, Italy). Nov 1987. NTIS, PC A27. Order Number DE88001915/JAW. (CONF-8707105—).

From International workshop on engineering design of next step reversed field pinch devices; Los Alamos, NM, USA (13 Jul 1987).

Some main physics aspects of the present Reverse Field Pinch (RFP) research are briefly summarized in relation to the RFX parameters and performance. The main parameters of RFX are reviewed and the critical aspects are underlined followed by a discussion of the expected plasma performance. 11 refs.

10449 (LA—11139-C, pp 303-308) **Reversed field pinch operation with a thin shell.** Ortolani, S.; Antoni, V.; Martini, S.; LaHaye, R.; Schaffer, M.; Tamano, T.; Taylor, P. (EURATOM-ENEA-CNR Association, Padova, Italy; GA Technologies, San Diego, CA). Nov 1987. NTIS, PC A27. Order Number DE88001915/JAW. (CONF-8707105—).

From International workshop on engineering design of next step reversed field pinch devices; Los Alamos, NM, USA (13 Jul 1987).

The pulse length in OHTE, operating with a thin conducting shell, has been prolonged by finer control of the plasma position. The plasma sensitivity to equilibrium control further proves the absence of any intrinsic limitation on the plasma performance due to the lack of the perfectly conducting shell. The addition of the external vertical field control has extended the discharge lengths from ~8 ms to ~14 ms, with a simultaneous increase in discharge reproducibility. Although MHD linear theory predicts that RFP plasmas are unstable with a resistive shell boundary, no change in gross MHD modes is observed experimentally. However, a toroidally localized kink mode (slinky" mode) due to nonlinear couplings of several internal kink modes has been found. The experimental indication that a relatively resistive shell (tau/sub shell/ $\approx$ 1/10 tau/sub pulse/) can provide an adequate MHD stability boundary introduces the possibility of major simplifications and optimizations in the design and construction of the next generation of RFP experiments. In particular, field error constraints on gaps and portholes become much less important and active accurate plasma positioning becomes possible. The latter may prove to be a crucial issue in RFP research where the dissipation in the outer plasma regions can largely determine the loop voltage and therefore the energy confinement time. 7 refs., 4 figs.

10450 (LA—11139-C, pp 317-327) **Loop voltages, field errors, field control, manipulators and other experience from HBTX1B relevant to next step RFP [Reversed Field Pinch].** Newton, A.A. (UKAEA Culham Lab., Abingdon). Nov 1987. NTIS, PC A27. Order Number DE88001915/JAW. (CONF-8707105—).

From International workshop on engineering design of next step reversed field pinch devices; Los Alamos, NM, USA (13 Jul 1987).

There has been considerable progress in achieving high electron temperatures and confinement on HBTX1B (R/a = 0.8/0.26m, I = 80-52OkA) by the reduction of magnetic field errors and control of equilibrium by vertical field. The best parameters achieved to date are the loop voltage falling to 8v with I = 80kA, T/sub e/ = 800ev at the end of a 10 ms pulse, and tau/sub Ee/ ~ 1ms. The X-ray spectrum shows an energetic electron component with characteristic energy of 8keV indicating that some electrons are now confined for 10^3 circuits of the torus. The toroidal field B/sub PHI/ ~ 8mT contrasts strongly with ohmically heated Tokamaks of similar current, dimensions and temperature which require ~2T. There improvements have been produced after minimizing the magnetic flux intersecting the wall and limiters by minimizing the magnetic field errors (gap flux and ripple), centering the toroidal equilibrium with a vertical field and finally removing the limiters. The error flux is found to contribute an extra term to the loop voltage V/sub A/ is proportional to /sub PHI n/ which is dominant in many conditions on HBTX1B. The main objective in this note is to examine the implication of this effect for next step RFP and to suggest criteria for their magnetic design. 10 refs., 3 figs., 2 tabs.

10451 (LA—11139-C, pp 328-333) **Reversed-field-pinch and ultra-low-q discharges in REPUTE-2.** Inoue, N.; Yoshida, Z.; Kamada, Y.; Saito, M.; Miyamoto, K. (Univ. of Tokyo, Japan). Nov 1987. NTIS, PC A27. Order Number DE88001915/JAW. (CONF-8707105—).

From International workshop on engineering design of next step reversed field pinch devices; Los Alamos, NM, USA (13 Jul 1987).

Ultra-low q (ULQ) and very-low q (VLQ) discharge experiments have been done using the REPUTE-1 RFP. It was found that in these q regime, the plasma density and beta are fairly high, and the confinement property is less sensitive to the error field compared to the RFP. However, since the temperature of the REPUTE-1 discharge is limited in low value because of the small plasma current due to the small toroidal field, its magnetic Reynolds number is too small to simulate the reactor plasma behavior. The radiation barrier has not been overcome yet, and consequently the energy confinement time is very short. In order to improve these aspects of the REPUTE-1 experiment, the REPUTE-2 is designed to produce higher toroidal field of 2T. The toroidal field increases slowly to the final value as in the case of the ramp-up mode of the RFP operation. The first stage of the REPUTE-2 project will be devoted to study the confinement physics of RFP, ULQ, and VLQ. In the second stage, innovation of these configurations, such as resistive shell RFP, neutral beam current drive, and higher current density, is planned. 8 refs., 1 fig., 2 tabs.

10452 (LA—11139-C, pp 335-342) **Plasma data analysis using statistical analysis system.** Yoshida, Z.; Iwata, Y.; Fukuda, Y.; Inoue, N. (Univ. of Tokyo, Japan). Nov 1987. NTIS, PC A27. Order Number DE88001915/JAW. (CONF-8707105—).

From International workshop on engineering design of next step reversed field pinch devices; Los Alamos, NM, USA (13 Jul 1987).

Multivariate factor analysis has been applied to a plasma data base of REPUTE-1. The characteristics of the reverse field pinch plasma in REPUTE-1 are shown to be explained by four independent parameters which are described in the report. The well known scaling laws F/sub chi/ proportional to I/sub p/, T/sub e/ proportional to I/sub p/, and tau/sub E/ proportional to N/sub e/ are also confirmed. 4 refs., 8 figs., 1 tab. (JDH)

10453 (LA—11139-C, pp 349-350) **Instabilities of an RFP [Reversed Field Pinch] with a resistive shell.** Marklin, G. (Los Alamos National Lab., NM). Nov 1987. NTIS, PC A27. Order Number DE88001915/JAW. (CONF-8707105—).

From International workshop on engineering design of next step reversed field pinch devices; Los Alamos, NM, USA (13 Jul 1987).

Ideal MHD growth rates have been computed for instabilities of an RFP with a thin resistive shell and a modified-Bessel-function equilibrium in a straight cylinder. In the thin shell model, the growth rate is proportional to the jump in the logarithmic derivative of the helical flux across the shell. 2 refs., 2 figs.

10454 (LA—11139-C, pp 351-364) **3-D MHD simulations of field errors in ZTH and ZT-40.** Sidikman, K.L.; Nebel, R.A.; Callen, J.D. (Los Alamos National Lab., NM). Nov 1987. NTIS, PC A27. Order Number DE88001915/JAW. (CONF-8707105—).

From International workshop on engineering design of next step reversed field pinch devices; Los Alamos, NM, USA (13 Jul 1987).

We have performed numerical simulations of the 3-D MHD response of an RFP plasma to external field errors. We have found that neither m = 0 perturbations from the toroidal field coils, nor perturbations from shell currents flowing around port holes pose a serious threat to grow large islands in ZT-H or ZT-40. In fact, the plasma acts to reduce the size of m = 0 islands. In particular, this means that ZTH, as designed, is not endangered by large field errors. It should adequately test RFP confinement properties. In general, our results show that MHD dynamics, including flow and dissipation, are important in understanding the plasma response to an external perturbation. 7 refs., 13 figs.

10455 (LA—11139-C, pp 365-374) **RFP [Reversed field Pinch] start-up and ZTH predictions.** Phillips, J.; Baker, D.; Gribble, R.; Munson, C. Nov 1987. NTIS, PC A27. Order Number DE88001915/JAW. (CONF-8707105—).

From International workshop on engineering design of next step reversed field pinch devices; Los Alamos, NM, USA (13 Jul 1987).

We consider in this short report the start-up of the toroidal current, I/sub phi/, in a Reversed-Field Pinch (RFP) experiment. The results of a series of runs on the ZT-40M experiment at Los Alamos, and techniques by which the volt-second input, (V.s)/sub in/, can be reduced are discussed. We also report our preliminary predictions for the start-up requirements for the ZTH experiment now under design and construction at Los Alamos. 5 refs., 10 figs.

10456 (ORNL/TM—10584) **Synchrotron radiation losses in Engineering Test Reactors (ETRs).** Uckan, N.A. (Oak Ridge National Lab., TN (USA)). Nov 1987. Contract AC05-84OR21400. 24p. (CONF-871007—70). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88003659/JAW.

From 12. symposium on fusion engineering; Monterey, CA, USA (12 Oct 1987).

In next-generation Engineering Test Reactors (ETRs), one major objective is envisioned to be a long-pulse or steady-state burn using noninductive current drive. At the high temperatures needed for efficient current drive, synchrotron radiation could represent a large power loss, especially if wall reflectivity (R) is very low. Many INTOR-class ETR designs [Fusion Engineering Reactor (FER), Next European Torus (NET), OTR, Tokamak Ignition/Burn Engineering Reactor (TIBER), etc.] call for carbon-covered surfaces for which wall reflectivity is uncertain. Global radiation losses are estimated for these devices using empirical expressions given by Trubnikov (and others). Various operating scenarios are evaluated under the assumption that the plasma performance is limited by either the density limit (typical of the ignition phase) or the beta limit (typical of the current drive phase). For a case with ≧90% wall reflectivity, synchrotron radiation is not a significant contribution to the overall energy balance (the ratio of synchrotron to alpha power is less than 10 to 20%, even at <T/sub e/> ~ 30 keV) and thus should not adversely alter performance in these devices. In extreme cases with 0% wall reflectivity, the ratio of synchrotron radiation to alpha power may approach 30 to 60% (depending on the device and limiting operating scenario), adversely affecting the performance characteristics. 12 refs., 7 tabs.

10457 (ORNL/TM—10585) **Nonlinear evolution of the internal kink mode in toroidal geometry for shaped tokamak plasmas.** Holmes, J.A.; Carreras, B.A.; Charlton, L.A.; Lynch, V.E.; Hastie, R.J.; Hender, T.C. (Oak Ridge National Lab., TN (USA)). Sep 1987. Contract AC05-84OR21400. 65p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE88003655/JAW.

The nonlinear evolution of the internal kink mode is studied in toroidal geometry for noncircular cross section tokamak plasmas. The study is focused on very low shear and hollow q profiles with q(rho) ≧ 1 for which the internal kink is unstable, in the latter case even at β - 0. The nonlinear evolution is dominated by ideal magnetohydrodynamics (MHD), and the instability saturates, giving a quasi-helical shift to the magnetic axis. The nonlinear saturation is caused by increased field line bending. Time scales of 10^3 tau/sub Hp/ and axis shifts of 20% are reached when changes in q on the order of 3 x 10^{-3} from the marginal profile are produced. 25 refs., 27 figs.

10458 (ORNL/TM—10611) **Physics analysis of the TIBER-II engineering test reactor.** Uckan, N.A.; Houlberg, W.A.; Attenberger, S.E.; Dory, R.A.; Spong, D.A.; Tolliver, J.S.; Sheffield, J. (Oak Ridge National Lab., TN (USA)). Nov 1987. Contract AC05-84OR21400. 26p. NTIS, PC A03/MF A01; GPO Dep. Order Number DE88003666/JAW.

Confinement capability, burn characteristics, heating and fueling requirements, and fast alpha particle effects are assessed for the TIBER-II engineering test reactor (ETR/ITER). Confinement predictions for a wide variety of empirical scaling laws show that ignition in TIBER-II (or similar ETR-like devices) is marginal at 10 MA, whereas the design goal to achieve noninductively driven, steady-state burn with Q > 5 can easily be attained. Operation at the higher plasma currents being discussed for ITER or the attainment of higher density limits and/or favorable H-mode scalings improves the ignition capability. Pellet penetration calculations indicate that density profile control with pellets may not be feasible even for pellet velocities up to about 50 km/s, however, density peaking could result from inward pinch effects, as frequently inferred from experiments. The fast alpha contribution to pressure is substantial (10 to 30%) at TIBER (or any ETR/ITER) burn temperatures (8 to 20 keV). A relatively low level of fast alpha radial diffusion or a modest level of thermal alpha buildup significantly influences the ignition and steady-state burn capability. The fast alpha population can also modify the background plasma ballooning mode stability boundaries, lowering the beta limit β/sub crit/ - in particular, operation at the high electron temperatures needed for efficient current drive can exacerbate this effect. The use of high-energy neutral beams offers the promise of two important improvements in projected performance: an effective method for noninductive current drive and a means for controlling the current density profile deep within the plasma, as required for stable operation at high beta levels. 14 refs., 10 figs., 1 tab.

10459 (OUP—87-35) **On the generation of secondary DC electric fields and densities in a rectangular wave guide.** Kildal, A. (Oslo Univ. (Norway). Fysisk Inst.). Nov 1987. 20p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88751475/JAW.

The generation of secondary DC field quantities in a nonmagnetized plasma in a rectangular waveguide is studied. The generation of DC electric fields as well as the modification of the charge density of the different charge species is considered.

10460 (PPPL—2462) **Current drive, anticurrent drive, and balanced injection.** von Goeler, S.; Stevens, J.; Beiersdorfer, P.; Bell, R.; Bernabei, S.; Bitter, M.; Cavallo, A.; Chu, T.K.; Fishman, H.; Hill, K. (Princeton Univ., NJ (USA). Plasma Physics Lab.). Aug 1987. Contract AC02-76CH03073. 16p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88003470/JAW.

In lower hybrid (LH) discharges, the number of suprathermal electrons is limited by the upper bound on the current density from the q = 1 condition, which is caused by the onset of the m = 1 MHD instability. The stored energy of suprathermal electrons, measured in terms of a poloidal beta, scales with plasma current as I/sub p/$^{-1}$. Potentially, these bounds represent very restrictive conditions for heating in larger machines. Consequently, it seems necessary to perform experiments where the electrons are driven in both directions, parallel and antiparallel to the magnetic field, i.e., bidirectional scenarios like anticurrent drive or balanced injection. Data from PLT relevant to these ideas are discussed. 6 refs., 4 figs.

10461 (PPPL—2463) Sawtooth effects in INTOR and TIBER. Stotler, D.P.; Post, D.; Bateman, G. (Princeton Univ., NJ (USA). Plasma Physics Lab.). Aug 1987. Contract AC02-76CH03073. 18p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88003468/JAW.

Transport simulations of the present designs for the INTOR and TIBER ignition devices predict that broad sawtooth oscillations will appear in these experiments. As was noted previously in studies of the Compact Ignition Tokamak, the primary effect of the oscillations is to reduce fusion power production on the average through profile flattening. Due to the disparate time scales for energy and current diffusion between sawtooth crashes, the simulations also produce peaked pressure profiles over a large low shear region inside the q = 1 surface (q is the safety factor). Pressure-driven modes will likely be unstable in this case. 5 figs., 2 tabs.

10462 (PPPL—2468) Feedback stabilization of the axisymmetric instability of a deformable tokamak plasma. Pomphrey, N.; Jardin, S.C. (Princeton Univ., NJ (USA). Plasma Physics Lab.). Sep 1987. Contract AC02-76CH03073. 21p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88003466/JAW.

We analyze the magnetohydrodynamic (MHD) stability of the axisymmetric system consisting of a free boundary, non-circular cross-section tokamak plasma, finite resistivity passive conductors, and an active feedback system with magnetic flux pickup loops, a proportional amplifier with gain G, and current carrying poloidal field coils. Numerical simulation of a system that is unstable with G = 0 shows that for some placements of the pickup loops, the system will remain unstable for all values of G, while for other placements of the loops, the system will be stable for G > G/sub crit/. This behavior is explained by analysis using an extended energy principle, and it is shown to result from the deformability of the plasma cross section. 9 refs., 5 figs.

10463 (PPPL—2469) A nonvariational code for calculating three-dimensional MHD [magnetohydrodynamic] equilibria. Greenside, H.S.; Reiman, A.H.; Salas, A. (Princeton Univ., NJ (USA). Plasma Physics Lab.). Sep 1987. Contract AC02-76CH03073. 64p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE88003467/JAW.

Details are presented of the PIES code, which uses a nonvariational algorithm for calculating fully three-dimensional MHD equilibria. The MHD equilibrium equations are directly iterated in special coordinates to find self-consistent currents and magnetic fields for given pressure and current profiles and for a given outermost magnetic surface. Three important advantages of this approach over previous methods are the ease with which net current profiles can be imposed, the explicit treatment of resonances, and the ability to handle magnetic islands and stochastic field lines. The convergence properties of the code are studied for several axisymmetric and nonaxisymmetric finite-β equilibria that have magnetic surfaces. 36 refs., 14 figs., 3 tabs.

10464 (PPPL—2470) Neoclassical diffusion of heavy impurities in a rotating tokamak plasma. Wong, K.L.; Cheng, C.Z. (Princeton Univ., NJ (USA). Plasma Physics Lab.). Aug 1987. Contract AC02-76CH03073. 13p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88003463/JAW.

Particle orbits in a rotating tokamak plasma are calculated from the equation of motion in the frame that rotates with the plasma. It is found that heavy particles in a rotating plasma can drift away from magnetic surfaces significantly faster, resulting in a diffusion coefficient much larger than that for a stationary plasma. Particle simulation is carried out and the results offer a qualitative explanation for some experimental data from the Tokamak Test Reactor (TFTR). 13 refs., 2 figs.

10465 (PPPL—2471) Calculation of fusion product angular correlation coefficients for fusion plasmas. Murphy, T.J. (Princeton Univ., NJ (USA). Plasma Physics Lab.). Aug 1987. Contract AC02-76CH03073. 29p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88003464/JAW.

The angular correlation coefficients for fusion products are calculated in the cases of Maxwellian and beam-target plasmas. Measurement of these coefficients as a localized ion temperature or fast-ion diagnostic is discussed. 8 refs., 7 figs., 1 tab.

10466 (PPPL—2472) Quenching of spontaneous emission coefficients in plasmas. Chung, Y.; Lemaire, P.; Suckewer, S. (Princeton Univ., NJ (USA). Plasma Physics Lab.). Sep 1987. Contract AC02-76CH03073. 15p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88003465/JAW.

We have observed changing Einstein coefficients of spontaneous emission as a function of electron density in CO_2 laser-produced plasmas. These measurements are based on the intensity branching ratio of CIV lines 5801 to 5812 A and 312.41 to 312.46 A which share a common upper level. Similar observations for CIII lines are also discussed. 12 refs., 3 figs.

10467 (PPPL—2474) Electron temperature profiles in high power neutral-beam-heated TFTR [Tokamak Fusion Test Reactor] plasmas. Taylor, G.; Grek, B.; Stauffer, F.J.; Goldston, R.J.; Fredrickson, E.D.; Wieland, R.M.; Zarnstorff, M.C. (Princeton Univ., NJ (USA). Plasma Physics Lab.; Maryland Univ., College Park (USA)). Sep 1987. Contract AC02-76CH03073. 15p. (CONF-870629—12). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88003459/JAW.

From 14. European conference on controlled fusion and plasma physics; Madrid, Spain (22 Jun 1987).

In 1986, the maximum neutral beam injection (NBI) power in the Tokamak Fusion Test Reactor (TFTR) was increased to 20 MW, with three beams co-parallel and one counter-parallel to I/sub p/. TFTR was operated over a wide range of plasma parameters; 2.5 < q/sub cyl/ < 10, and 2 x 10^{19} < anti n/sub e/ < 7 x 10^{19} m^{-3}. Data bases have been constructed with over 600 measured electron temperature profiles from multipoint TV Thomson scattering which span much of this parameter space. We have also examined electron temperature profile shapes from electron cyclotron emission at the fundamental ordinary mode and second harmonic extraordinary mode for a subset of these discharges. In the light of recent work on "profile consistency" we have analyzed these temperature profiles in the range 0.3 < (r/a) < 0.9 to determine if a profile shape exists which is insensitive to q/sub cyl/ and beam-heating profile. Data from both sides of the temperature profile [T/sub e/(R)] were mapped to magnetic flux surfaces [T/sub e/(r/a)]. Although T/sub e/(r/a), in the region where 0.3 < r/a < 0.9 was found to be slightly broader at lower q/sub cyl/, it was found to be remarkably insensitive to β/sub p/, to the fraction of NBI power injected co-parallel to I/sub p/, and to the heating profile going from peaked on axis, to hollow. 10 refs., 8 figs.

10468 (PPPL—2476) Ion temperature from tangential charge exchange neutral analysis on the Tokamak Fusion Test Reactor. Fiore, C.L.; Medley, S.S.; Hammett, G.W.; Kaita, R.; Roquemore, A.L.; Scott, S.D. (Massachusetts Inst. of Tech., Cambridge (USA). Plasma Fusion Center; Princeton Univ., NJ (USA). Plasma Physics Lab.). Sep 1987. Contract AC02-76CH03073. 49p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88003461/JAW.

Fokker-Planck simulations of the Tokamak Fusion Test Reactor (TFTR) energetic ion mode discharges were performed to evaluate the utility of deriving the central ion temperature, T/sub i/, from deuterium neutral beam charge exchange spectra above the neutral beam injection energy. The T/sub i/ values obtained from fitting the calculated spectra obtained from sightlines nearly tangent to the neutral beam injection radius reproduce the central ion temperature within +-10% over the full range of TFTR energetic ion mode parameters. The code simulations demonstrate that the ion temperature obtained from the high energy tangential deuterium charge exchange spectrum is insensitive to variations in the plasma density, Z/sub eff/, plasma current, loop voltage, and injected neutral beam power and energy. Use of this method to reduce charge exchange data from TFTR energetic ion mode plasmas is demonstrated. 17 refs., 22 figs., 2 tabs.

10469 (RAL—86-065) Inner-shell X-ray line spectra of highly ionized titanium, chromium, iron and nickel and their application to laboratory plasmas. Lemen, J.R.; Phillips, K.J.H.; Doschek, G.A.; Cowan, R.D. (Rutherford Appleton Lab., Chilton (UK)). Jun 1986. 45p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88750791/JAW.

The intensities of X-ray lines due to inner-shell 1s-2p transitions in 0 I-, N I-, and C I-like ions of Ti XV-XVII, Cr XVII-XIX, Fe XIX-XXI, and Ni XXI-XXIII, seen in tokamak plasmas are calculated. The lines are assumed to be formed by dielectronic recombination and inner-shell excitation. The dielectronic rates were calculated using a suite of computer programs developed by one of the authors. The inner-shell contribution was estimated by van Regemorter's formula. The present calculations were applied to the problem of radial ion diffusion in tokamaks. Spectra were calculated by integrating along various lines-of-sight to simulate what might be observed by an actual spectrometer viewing a tokamak plasma. A method for determining the diffusion coefficient from tokamak observations is discussed.

10470 (RAL—86-067) New measurements of spontaneous transition probabilities for beryllium-like ions. Lang, J.; Hardcastle, R.A.; McWhirter, R.W.P.; Spurrett, P.H. (Rutherford Appleton Lab., Chilton (UK)). Jun 1986. 29p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88750790/JAW.

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The authors describe measurements of spectral line intensities for pairs of transitions having common upper levels and thus derive the branching ratios of their spontaneous radiative transition probabilities. These are then combined with the results of measurements of the radiative lifetimes of the upper levels by other authors to obtain values of the individual transition probabilities. The results are for transitions in NIV, OV and NeVII and are given with a claimed accuracy of between 7% and 38%. These are compared with values calculated theoretically. For some of the simpler electric dipole transitions good agreement is found. On the other hand for some of the other transitions which in certain cases are only possible because of configuration interaction disparities between the present measurements and theory are as large as x5.

10471 (UCRL—53829) Parametric study of axisymmetric fusion devices. Ducar, W.S. (Lawrence Livermore National Lab., CA (USA)). Nov 1987. Contract W-7405-ENG-48. 187p. NTIS, PC A09/MF A01; 1; GPO Dep. Order Number DE88003440/JAW.

Three different axisymmetric magnetic mirror fusion machines are examined in order to optimize the ratio of the fusion power produced by them to the power injected into them to maintain the plasma. This ratio is called Q. These three devices were chosen to study the continuum between a simple mirror and a tandem mirror. This allowed the evolutionary process leading from the simple to the tandem mirror to be examined in detail. In particular, the Kelley mirror, which corresponds to the middle step, was examined in depth for the first time. 37 refs., 54 figs., 17 tabs.

10472 (UCRL—97582) ECRH [electron-cyclotron resonance heating]-heated distributions in thermal-barrier tandem mirrors. Cohen, R.H.; LoDestro, L.L. (Lawrence Livermore National Lab., CA (USA)). 1 Sep 1987. Contract W-7405-ENG-48. 12p. (CONF-8709203—1). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88002390/JAW.

From International school of plasma physics; Varenna, Italy (1 Sep 1987).

The distribution function is calculated for electrons subjected to strong electron-cyclotron resonance heating (ECRH) at the plug and barrier in a tandem-mirror thermal-barrier cell. When ECRH diffusion locally dominates over collisions and a boundary condition (associated with electrons passing to the center cell) imposes variations on the distribution function rapid compared to the variation of the ECRH and collisional diffusion coefficients, the kinetic equation can be reduced approximately to Laplace's equation. For the typical case where velocity space is divided into distinct regions in which plug and barrier ECRH dominate, the solution in each region can be expressed in terms of the plasma dispersion function or exponential integrals, according to whether the passing electrons are dominated by collisions or ECRH, respectively. The analytic results agree well with Fokker-Planck code results, in terms of both velocity-space structure and values of moments. 10 refs., 4 figs.

10473 DSTAR: A comprehensive tokamak resistive disruption model for vacuum vessel components. Merrill, B.J.; Jardin, S.C. (Idaho National Engineering Lab., Idaho Falls, USA; Princeton Univ., NJ, USA. Plasma Physics Lab.). *Fusion Energy and Design;* 5: No. 3, 235-249(Oct 1987). Contract AC07-76ID01570.

A computer code, DSTAR, has recently been developed to quantify the surface erosion and induced forces than can occur during major tokamak plasma disruptions. A disruption analysis has been performed for the TFCX fusion device. The limiters and inboard first wall were assumed to be clad with beryllium. Disruption simulations were performed with and without these structures present, to determine their electromagnetic influence. The results with structure show that the ablated wall material is transported poloidally, as well as radially, in the plasma causing the outermost regions of the plasma to cool. The plasma moves downward and deforms while maintaining contact with the lower limiter. This motion maintains the peak impurity radiant source directly above the exposed surface. For the disruption simulation without the vacuum vessel included, the plasma moves radially along the lower limiter until it contacts the inboard wall, causing ablation of this surface as well. The conclusion is drawn that disruption simulations that do not include both the thermal and electromagnetic response of the vaccum vessel will not result in an accurate prediction.

10474 Requirements for ohmic ignition. Hutchinson, I.H. (Massachusetts Institute of Technology, Cambridge). *Journal of Fusion Energy;* 6: No. 3, 257-264(Sep 1987). Contract AC02-78ET51013.

An analysis of ohmic ignition criteria is presented, giving the requirements on T, ntau, and n/j in a form easily applicable to various confinement assumptions. For circular cross-section NeoAlcator tokamaks with Spitzer resistivity, a value of B^2a approximately equal to 250 T^2m is required. The outstanding uncertainties in schemes to lower this value are how much increase in current density is achievable by plasma shaping and what the exact NeoAlcator coefficient is.

10475 Simulation studies of thermal relaxation and dynamic shielding in plasmas. Jechart, I. Los Angeles, CA; Univ. of California (1987). 159p. University Microfilms Order No. 87-12,333.

Thesis (Ph.D).

Several aspects of charged-particle behavior and the interaction of those charged particles with plasma are investigated using self-consistent computer particle simulations and analytical methods. The thermal relaxation of a two-dimensional plasma perpendicular to a magnetic field is studied. A simple model describes the anomalous relaxation process in terms of correlated, or resonant, collisions. The predictions of a simple impulse approximation which includes correlations are tested with 2-D electrostatic particle simulations of the thermalization process. The simulations demonstrate that finite-size particle effects reduce the thermalization rate when the magnetic field becomes so large that the particle size is comparable to the cyclotron radius. For the preceding work the entropy provided, via a cut-off, a measure of the relaxation, and its explicit time dependence is investigated. A 2-D gas in Brownian motion is examined whose velocity distribution function satisfies the Fokker-Planck equation and whose initial f(v) is a Waterbag. Particle dynamics are investigated again with the process of Debye shielding. Special attention is given to the potential around fast particles for whom kinetic theory predicts a large wake.

10476 Confinement of high-density pellet-fueled discharges in TFTR. Milora, S.L.; Schmidt, G.L.; Arunasalam, V. (Oak Ridge National Lab., TN, USA; Princeton Univ., NJ, USA. Plasma Physics Lab.). *Plasma Physics and Controlled Fusion;* 28: No. 9A, 1435-1439(Sep 1986). (CONF-8604369—).

From 13. European conference on controlled fusion and plasma heating; Schliersee, DE, USA (14 Apr 1986).

TFTR pellet injection results have been extended to higher density and ntau in plasmas limited by a graphite inner-wall belt limiter. Increased pellet penetration and larger density increases were achieved by operation at reduced plasma current (1.6 MA) and minor and major radius (70 cm and 235 cm). Under these conditions, beam heating results have been extended to 7 MW.

10477 Transport in drift waves. Horton, W. (Institute for Fusion Studies, The Univ. of Texas at Austin, Austin, TX 78712-1060). pp 159-175 of Statistical plasma physics: Proceedings of Workshop of US-Japan joint institute for fusion theory program. Nagoya, Japan; Institute of Plasma Physics (1986). (CONF-8602116—).

From US/Japan workshop on statistical plasma physics; Nagoya, Japan (17 Feb 1986).

The conditions for the onset of stochasticity and the nature of the ensuing transport are investigated for particle motion in two drift waves.

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REFER ALSO TO CITATION(S) 8681, 8923, 9062, 9299, 9437, 10021, 10197, 10445, 10449, 10458, 10476

10478 (ANL/FPP/TM—214) Application of high temperature ceramic superconductors (CSC) to commercial tokamak reactors. Ehst, D.A.; Kim, S.; Gohar, Y.; Turner, L.; Smith, D.L.; Mattas, R. (Argonne National Lab., IL (USA). Fusion Power Program). Oct 1987. Contract W-31109-ENG-38. 27p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88003973/JAW.

Ceramic superconductors operating near liquid nitrogen temperature may experience higher heating rates without losing stability, compared to conventional superconductors. This will permit cable design with less stabilizer, reducing fabrication costs for large fusion magnets. Magnet performance is studied for different operating current densities in the superconductor, and cost benefits to commercial tokamak reactors are estimated. It appears that 10 kA . cm^{-2} (at 77 K and ~10 T) is a target current density which must be achieved in order for the ceramic superconductors to compete with conventional materials. At current densities around 50 kA . cm^{-2} most potential benefits have already been gained, as magnet structural steel begins to dominate the cost at this point. For a steady state reactor reductions of ~7% are forecast for the overall capital cost of the power plant in the best case. An additional ~3% cost saving is possible for pulsed tokamaks. 9 refs., 4 figs., 8 tabs.

10479 (CONF-870422—9) CRITIC-I: Instrumented lithium oxide irradiation: Part 1, Lithium oxide fabrication and characteristics. Applegate, D.S.; Poeppel, R.B. (Argonne National Lab., IL (USA)). Jun 1987. Contract W-31109-ENG-38. 15p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88003109/JAW.

From 89. annual meeting of the American Ceramic Society; Pittsburgh, PA, USA (26 Apr 1987).

Fine-grained, sinterable lithium oxide powder was prepared by high-temperature vacuum calcination of molten lithium carbonate. The product was ball milled, cold pressed, and fired in an oxygen atmosphere. The fired density, grain size, and surface roughness varied widely with firing schedule. Most variations were attributed to moisture content. Rings of high-density, sintered lithium oxide will be used in an in-reactor experiment to measure tritium release. 2 refs., 8 figs., 1 tab.

10480 (CONF-870901—13) The IEA large coil task test results in IFSMTF. Lubell, M.S.; Clinard, J.A.; Dreaner, L.; Fietz, W.A.; Fletcher, W.M.; Haubenreich, P.N.; Lue, J.W.; Luton, J.N.; McManamy, T.J.; Schwenterly, S.W. (Oak Ridge National Lab., TN (USA); Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.); Japan Atomic Energy Research Inst., Tokai, Ibaraki; Swiss Inst. for Nuclear Research, Villigen). 1987. Contract AC05-84OR21400. 6p. NTIS, PC A02. Order Number DE88002783/JAW.

From 10. international conference on magnet technology (MT-10); Boston, MA, USA (21 Sep 1987).

The Large Coil Task (LCT) is an international collaboration of the United States, EURATOM, Japan, and Switzerland to develop large superconducting magnets for fusion reactors. The testing phase of LCT was completed on September 3, 1987. All six coils exceeded the design goals, both as single coils and in six-coil toroidal tests. In addition, a symmetric torus test was performed in which a maximum field of 9 T was reached in all coils simultaneously. These are by far the largest magnets (either in size, weight, or stored energy) ever to achieve such a field. 6 refs., 6 figs., 3 tabs.

10481 (CONF-871007—60) Design considerations for a negative ion source for dc operation of high-power, multi-megaelectron-volt neutral beams. Tsai, C.C.; Stirling, W.L.; Akerman, M.A.; Becraft, W.R.; Dagenhart, W.K.; Haselton, H.H.; Ryan, P.M.; Schechter, D.E.; Wheaton, J.H. (Oak Ridge National Lab., TN (USA)). 1987. Contract AC05-84OR21400. 6p. NTIS, PC A02. Order Number DE88002692/JAW.

From 12. symposium on fusion engineering; Monterey, CA, USA (12 Oct 1987).

A dc negative hydrogen and/or deuterium ion source is needed to produce high-power, high-energy neutral beams for alpha diagnostics and current drive applications in fusion devices. The favorable beam particle energy for such applications extends to 1.5 MeV/amu. Continuous-wave (cw) radiofrequency quadrupole (RFQ) accelerators have been proposed to accelerate negative ions efficiently to this energy range. In this paper, the desired beam properties for ion beams injected into cw RFQ accelerators are summarized. A number of candidate ion sources being developed at Culham, JAERI, LBL, and ORNL may prove useful for these applications. The properties of the Volume Ionization with Transverse Extraction (VITEX) ion sources being developed at ORNL are presented. Scaling such a dc ion source to produce ampere beams is discussed. 53 refs., 4 figs., 2 tabs.

10482 (CONF-871007—61-Vugraphs) Comparative analysis of INTOR-like designs. Flanagan, C.; Galambos, J.; Peng, M. (Oak Ridge National Lab., TN (USA)). 1987. Contract AC05-84OR21400. 16p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88002622/JAW.

From 12. symposium on fusion engineering; Monterey, CA, USA (12 Oct 1987).

INTOR-like designs are examined to determine what design aspects contribute the most to design differences. Design aspects which are considered include benchmark calculations, relative costs, shielding designs, and ratios differences. The comparisons are accomplished by means of the TETRA Systems Code, demonstrating the utility of this code for system designers. (DWL)

10483 (CONF-871007—67) Engineering design of a liquid metal cooled self-pumped limiter for a tokamak reactor. Brooks, J.N.; Cha, Y.; Hassanein, A.; Majumdar, S.; Mattas, R.F.; Smith, D.L. (Argonne National Lab., IL (USA)). Oct 1987. Contract W-31109-ENG-38. 5p. NTIS, PC A02. Order Number DE88002845/JAW.

From 12. symposium on fusion engineering; Monterey, CA, USA (12 Oct 1987).

A lithium cooled self-pumped limiter has been designed as the impurity control system for the TPSS high-β power reactor conceptual design. The limiter removes helium by trapping impinging helium ions in freshly deposited vanadium surface layers in a slot region. No hydrogen is removed and no pumps or vacuum penetrations are used, thereby eliminating penetration shielding and reducing tritium handling. The limiter is composed of a vanadium alloy structure with a 2mm tungsten cladding on the front face and leading edges for sputtering control. Up to ~3cm of vanadium trapping material is deposited in the slot region during 5 years of operation. A key design feature is the use of a calcium oxide electrical insulator which coats the limiter coolant channels to reduce MHD pressure drops. A combination of high lithium coolant velocity, made possible by the insulator, and mid-limiter manifolding has been used to obtain acceptable material temperatures with moderately high heat fluxes (3 to 5 mw/m^2). Overall, a limiter lifetime of

~5 years is predicted by stress and lifetime analysis. This would permit maintenance free impurity control operation between first wall/blanket replacement periods. 4 refs., 3 figs., 1 tab.

10484 **(CONF-871007—68) Nuclear modules of ITER tokamak systems code.** Gohar, Y.; Baker, C.; Brooks, J.; Finn, P.; Hassanein, A.; Willms, S.; Barr, W.; Bushigin, A.; Kalyanam, K.M.; Haines, J. (Argonne National Lab., IL (USA); Los Alamos National Lab., NM (USA); Lawrence Livermore National Lab., CA (USA); Ontario Hydro, Mississauga (Canada); Oak Ridge National Lab., TN (USA)). Oct 1987. Contract W-31109-ENG-38. 9p. NTIS, PC A02. Order Number DE88002884/JAW.

From 12. symposium on fusion engineering; Monterey, CA, USA (12 Oct 1987).

Nuclear modules were developed to model various reactor components in the ITER systems code. Several design options and cost algorithms are included for each component. The first wall, blanket and shield modules calculate the beryllium zone thickness, the disruptions results, the nuclear responses in different components including the toroidal field coils. Tungsten shield/water coolant/steel structure and steel shield/water coolant are the shield options for the inboard and outboard sections of the reactor. Lithium nitrate dissolved in the water coolant with a variable beryllium zone thickness in the outboard section of the reactor provides the tritium breeding capability. The reactor vault module defines the thickness of the reactor wall and the roof based on the dose equivalent during operation including skyshine contribution. The impurity control module provides the design parameters for the divertor including plate design, heat load, erosion rate, tritium permeation through the plate material to the coolant, plasma contamination by sputtered impurities, and plate lifetime. Several materials: Be, C, V, Mo, and W can be used for the divertor plate to cover a range of plasma edge temperatures. The tritium module calculates tritium and deuterium flow rates for the reactor plant. The tritium inventory in the fuelers, neutral beams, vacuum pumps, impurity control, first wall, and blanket is calculated. Tritium requirements are provided for different operating conditions. The nuclear models are summarized in this paper including the different design options and key analyses of each module. 39 refs., 3 tabs.

10485 **(CONF-871007—69) Low technology high tritium breeding blanket concept.** Gohar, Y.; Baker, C.C.; Smith, D.L.; Billone, M.C.; Cha, Y.S.; Clemmer, R.; Finn, P.A.; Hassanein, A.M.; Johnson, C.E.; Liu, Y. (Argonne National Lab., IL (USA)). Oct 1987. Contract W-31109-ENG-38. 9p. NTIS, PC A02. Order Number DE88002883/JAW.

From 12. symposium on fusion engineering; Monterey, CA, USA (12 Oct 1987).

The main function of this low technology blanket is to produce the necessary tritium for INTOR operation with minimum first wall coverage. The INTOR first wall, blanket, and shield are constrained by the dimensions of the reference design and the protection criteria required for different reactor components and dose equivalent after shutdown in the reactor hall. It is assumed that the blanket operation at commercial power reactor conditions and the proper temperature for power generation can be sacrificed to achieve the highest possible tritium breeding ratio with minimum additional research and developments and minimal impact on reactor design and operation. A set of blanket evaluation criteria has been used to compare possible blanket concepts. Six areas: performance, operating requirements, impact on reactor design and operation, safety and environmental impact, technology assessment, and cost have been defined for the evaluation process. A water-cooled blanket was developed to operate with a low temperature and pressure. The developed blanket contains a 24 cm of beryllium and 6 cm of solid breeder both with a 0.8 density factor. This blanket provides a local tritium breeding ratio of ~2.0. The water coolant is isolated from the breeder material by several zones which eliminates the tritium buildup in the water by permeation and reduces the changes for water-breeder interaction. This improves the safety and environmental aspects of the blanket and eliminates the costly process of the tritium recovery from the water. 12 refs., 13 tabs.

10486 **(CONF-871007—73) Tokamak power systems studies: A second stability power reactor.** Ehst, D.; Baker, C.; Billone, M.; Brooks, J.; Cha, Y.; Evans, K. Jr.; Finn, P.; Gohar, Y.; Hassanein, A.; Liu, Y. (Argonne National Lab., IL (USA)). Oct 1987. Contract W-31109-ENG-38. 5p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88002890/JAW.

From 12. symposium on fusion engineering; Monterey, CA, USA (12 Oct 1987).

A number of innovative physics and engineering features have been studied which promise to greatly improve the reactor prospects of tokamaks relative to STARFIRE. A reference design point has been developed with the following features: large aspect ratio (A = 6); high beta ($\beta \simeq 0.20$), with only mild shaping and no indentation, which brings the maximum toroidal field down to 7 T; low toroidal current (I ≃ 5MA), which reduces the cost of the current drive and EF coil system; and steady-state operation with combined fast wave and lower hybrid wave current drive. The key to high beta operation with low toroidal current lies in utilizing second stability regime equilibria with control of the current achieved by the appropriate choice of wave frequencies and spectra. By selecting an axial safety factor q(o) = 2.0, MHD stability has been found above $\beta \simeq 0.20$. Additional features include: impurity control with self-pumped limiters which bury helium on continuously deposited metal surfaces; liquid Li-cooled blanket which provides good performance with low pressure operation; vanadium alloy blanket structure for higher thermal efficiency (eta = 0.42), longer lifetime and reduced activation; and reduced reactor mass (higher power density) due to smaller TF coil, less shielding, fewer blanket penetrations, and higher wall loading. At low neutron wall loads this device represents a minimum capital cost unit. However, economies of scale are strong, and eventually higher wall loads (W ≃ 8 MW/m², P/sub net/ = 1400 MW) may prove most attractive. Preliminary investigations show inherently safe operation is likely at W ≧ 5 MW/m². 15 refs., 3 figs., 1 tab.

10487 **(CONF-871036—12) Ceramic breeder materials.** Johnson, C.E.; Kummerer, K.R.; Roth, E. (Argonne National Lab., IL (USA); Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.); CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). 1987. Contract W-31109-ENG-38. 46p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88002966/JAW.

From 3. international conference on fusion reactor materials; Karlsruhe, F.R. Germany (4 Oct 1987).

Ceramic materials are under investigation as potential breeder material in fusion reactors. This paper will review candidate materials with respect to fabrication routes and characterization, properties in as-fabricated and irradiated condition, and experimental results from laboratory and inpile investigations on tritium transport and release. Also discussed are the resources of beryllium, which is being considered as a neutron multiplier. The comparison of ceramic properties that is attempted here aims at the identification of the most-promising material for use in a tritium breeding blanket. 82 refs., 12 figs., 5 tabs.

10488 **(CONF-871036—13) Irradiation creep and swelling of AISI 316 to exposures of 130 dpa at 385 to 400°C.** Garner, F.A.; Porter, D.L. (Pacific Northwest Lab., Richland, WA (USA); Argonne National Lab., IL (USA)). Sep 1987. Contract W-31109-ENG-38;AC06-76RL01830. 35p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88002964/JAW.

From 3. international conference on fusion reactor materials; Karlsruhe, F.R. Germany (4 Oct 1987).

The creep and swelling of AISI 316 stainless steel have been studied at 385 to 400°C in EBR-II to doses of 130 dpa. Most creep capsules were operated at constant stress and temperature but midlife changes in these variable were also made. This paper concentrates on the behavior of the 20% cold-worked condition but five other conditions were also studied. Swelling at ≦00°C was found to lose the sensitivity to stress exhibited at higher temperatures while the creep rate was found to retain linear dependencies on both stress and swelling rate. The creep coefficients extracted at 400°C agree with those found in other experiments conducted at higher temperatures. In the temperature range of ≦400°C, swelling

is in the recombination-dominated regime and the swelling rate falls strongly away from the ~1%/dpa rate observed at higher temperatures. These lower rates of creep and swelling, coupled with the attainment of high damage levels without failure, encourage the use of AISI 316 in the construction of water-cooled fusion first walls operating at temperatures below 400°C. 23 refs., 8 figs.

10489 **(CONF-871036—14) Modeling of tritium behavior in ceramic breeder materials.** Kopasz, J.P.; Tam, S.W.; Johnson, C.E. (Argonne National Lab., IL (USA)). 1987. Contract W-31109-ENG-38. 19p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88002967/JAW.

From 3. international conference on fusion reactor materials; Karlsruhe, F.R. Germany (4 Oct 1987).

The model described in this paper considers diffusion and desorption as the rate-controlling mechanisms for tritium release from a ceramic breeder material. This model was used to predict the tritium release from samples of Li_2SiO_3 and $LiAlO_2$, given the temperature history of the samples. The diffusion-desorption model did a better job of predicting the tritium release for these samples under pure helium purge gas than did a pure diffusion model using the best values for the diffusivity of these materials available. The activation energies of desorption found from the best fit of the predicted tritium release to the observed release were 105-108 kJ/mol for Li_2SiO_3 and 85.7 kJ/mol for $LiAlO_2$. These values are in fair agreement with activation energies reported in the literature. 13 refs., 6 figs.

10490 **(CONF-871036—15) Production of long-lived activities in fusion materials.** Greenwood, L.R.; Bowers, D.L. (Argonne National Lab., IL (USA)). 1987. Contract W-31109-ENG-38. 12p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88002963/JAW.

From 3. international conference on fusion reactor materials; Karlsruhe, F.R. Germany (4 Oct 1987).

Neutron cross sections have been measured near 14 MeV for reactions leading to long-lived radioisotopes in fusion materials. Results are summarized for various reactions leading to ^{26}Al (720,000 y), ^{55}Fe (2.73 y), ^{63}Ni (100 y), ^{59}Ni (76,000 y), and ^{94}Nb (20,300 y). New data are presented for the production of ^{91}Nb (680 y) from ^{92}Mo, and from ^{96}Mo (3500 y) and /sup 93m/Nb (13.6 y) for ^{94}Mo. Our measurements suggest that the half-life of ^{91}Nb may be shorter (350 y) than previous estimates. Measured cross sections are used to predict the production of these isotopes for various fusion reactor designs. 20 refs., 4 tabs.

10491 **(CONF-871036—16) Stress-corrosion cracking susceptibility of V-15Cr-5Ti in pressurized water at 288°C.** Diercks, D.R.; Smith, D.L. (Argonne National Lab., IL (USA)). Jul 1987. Contract W-31109-ENG-38. 17p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88002866/JAW.

From 3. international conference on fusion reactor materials; Karlsruhe, F.R. Germany (4 Oct 1987).

The stress-corrosion cracking susceptibility of V-15Cr-5Ti in pressurized water at 288°C has been evaluated by means of constant extension rate tensile (CERT) tests in a refreshed autoclave system. The test environments included high-purity water as well as water containing SO_4^{2-} and NO_3^- impurities at a concentration of 10 wppM. Strain rates from 1×10^{-6} to 5×10^{-8} s^{-1} were employed, and dissolved oxygen levels ranged from <0.005 to 7.9 wppM. Test times were from 3.2 to 619 h. No stress corrosion cracking was observed under any of the test conditions. These results were analyzed using measured electrochemical potentials, available Pourbaix diagram information, and the observed oxidation behavior. 7 refs., 5 figs., 1 tab.

10492 **(CONF-871036—17) Microstructural evolution and yield stress increase for ion-irradiated V-15Cr-5Ti alloy.** Loomis, B.A.; Kestel, B.J.; Smith, D.L. (Argonne National Lab., IL (USA)). Sep 1987. Contract W-31109-ENG-38. 15p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88002959/JAW.

From 3. international conference on fusion reactor materials; Karlsruhe, F.R. Germany (4 Oct 1987).

The effect of 4-MeV $^{58}Ni^{++}$ ion irradiation on the microstructure of the V-15Cr-5Ti alloy was determined for irradiation temperatures ranging from 550 to 750°C and for damage levels of 50 to 260 dpa. The swelling of the alloy that could be attributed to voids was negligible (<0.1%). The principle effect of the irradiation was to induce the formation of disc-shape precipitates in the alloy microstructure. The increase of the yield stress for the alloy resulting from the irradiations was evaluated from the irradiation-produced dislocation density and the number density and size of irradiation-produced precipitates. These evaluations showed that the increase of yield stress for the alloy on ion irradiation had a maximum value at ~50 dpa, and the increase of yield stress decreased for irradiation temperatures above 600°C. 8 refs., 5 figs., 2 tabs.

10493 **(CONF-871036—18) Thermodynamic and kinetic observations on $LiAlO_2$: Adsorption, dissolution, and evolution of water vapor.** Fischer, A.K.; Johnson, C.E. (Argonne National Lab., IL (USA)). 1987. Contract W-31109-ENG-38. 15p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88002943/JAW.

From 3. international conference on fusion reactor materials; Karlsruhe, F.R. Germany (4 Oct 1987).

Accounting for the tritium inventory in the tritium breeding blanket of a fusion reactor requires, among other things, knowledge of the adsorption-desorption characteristics of tritium-containing species on the breeder surface, the solubility of triotoxide and tritide in the bulk breeder, and the kinetics of various processes that transport tritium out of the breeder. An experimental study on $LiAlO_2$ is presented that provides information for the thermodynamics of adsorption of $H_2O(g)$ and dissolution of OH^-, and for the kinetics of the evolution of $H_2O(g)$. The measurements were made with ultra high purity helium as the sweep gas and are in the high oxygen activity region. Detailed thermodynamic calculations performed earlier indicated that the solubility of hydroxide in a breeder is, in general, dependent on the oxygen activity. For low oxygen activities (below about 10^{-15}) the dependence is significant, but for oxygen activities above this level, such as in high purity helium, the dependence is slight. Although the effect of low oxygen activity on the measured values was not addressed, the question will be examined experimentally by the use of gases with fixed ratios of H_2O:H_2. Effects related to low oxygen activities are the subject of future reports. 14 refs., 3 figs.

10494 **(CONF-871036—19) Experimental method for investigating helium effects in irradiated vanadium.** Smith, D.L.; Matsui, H.; Greenwood, L.; Loomis, B. (Argonne National Lab., IL (USA); Tohoku Univ., Sendai (Japan). Inst. for Materials Research). Oct 1987. Contract W-31109-ENG-38. 18p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88002891/JAW.

From 3. international conference on fusion reactor materials; Karlsruhe, F.R. Germany (4 Oct 1987).

Analyses have been performed which indicate that an effective method for experimentally investigating helium effects in neutron irradiated vanadium base alloys can be developed. The experimental procedure involves only modest modifications to existing procedures currently used for irradiation testing of vanadium-base alloys in the FFTF reactor. Helium is generated in the vanadium alloy by decay of tritium which is either preinjected or generated within the test capsule. Calculations indicate that nearly constant He/dpa ratios of desired magnitude can be attained by proper selection of experimental parameters. The proposed method could have a major impact on the development of vanadium base alloys for fusion reactor applications. 8 refs., 4 figs.

10495 **(CONF-871036—20) Compatibility of ferritic steels in forced circulation lithium and Pb-17Li systems.** Chopra, O.K.; Smith, D.L. (Argonne National Lab., IL (USA)). Aug 1987. Contract W-31109-ENG-38. 20p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88003091/JAW.

From 3. international conference on fusion reactor materials; Karlsruhe, F.R. Germany (4 Oct 1987).

Corrosion data are presented for various ferritic steels in flowing lithium and Pb-17Li environments at temperatures between 371 and 538°C. The corrosion behavior is evaluated by measuring the weight loss as a function of time and temperature. The significance of chemical interactions between nitrogen and alloy elements

on the corrosion behavior in lithium is discussed. 19 refs., 8 figs., 2 tabs.

10496 **(CONF-871036—21) Corrosion behavior of vanadium alloys in flowing lithium.** Chopra, O.K.; Smith, D.L. (Argonne National Lab., IL (USA)). Aug 1987. Contract W-31109-ENG-38. 20p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88002900/JAW.

From 3. international conference on fusion reactor materials; Karlsruhe, F.R. Germany (4 Oct 1987).

Corrosion data are presented for several vanadium alloys exposed to flowing lithium at 427, 482, and 538°C. The corrosion behavior is evaluated by weight change measurements. Metallographic results and data on the nonmetallic element transfer in lithium-exposed specimens are also presented. The influence of alloy composition and exposure conditions on the corrosion behavior of vanadium alloys is discussed. 6 refs., 9 figs., 2 tabs.

10497 **(CONF-871036—23) New technique for enhancing helium production in ferritic materials.** Greenwood, L.R.; Graczyk, D.G.; Kneff, D.W. (Argonne National Lab., IL (USA); Rockwell International Corp., Canoga Park, CA (USA)). Oct 1987. Contract W-31109-ENG-38. 14p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88003048/JAW.

From 3. international conference on fusion reactor materials; Karlsruhe, F.R. Germany (4 Oct 1987).

Analyses of iron samples irradiated up to 10^{27} n/m^2 in HFIR found more helium than was expected from fast neutron reactions at high neutron fluences. The helium excess increases systematically with neutron exposure, suggesting a transmutation-driven process. The extra helium may be produced in two different ways, either by fast neutron reactions on the transmuted isotopes of iron or by a thermal neutron reaction with the radioactive isotope ^{55}Fe. Radiometric and mass spectrometric measurements of the iron isotopes composing the irradiated samples have been used to determine limits on the cross sections for each process. Either of these processes can be used to enhance helium production in ferritic materials during irradiations in mixed-spectrum reactors by isotopically enriching the samples. Further work is needed to clarify the reaction mechanisms and helium production cross sections. Our measurements determined the thermal neutron total absorption cross section of ^{55}Fe to be 13.2 +- 2.1 barns. 16 refs., 3 figs., 3 tabs.

10498 **(CONF-871036—24) Strength, ductility, and ductile-brittle transition temperature for MFR [magnetic fusion reactor] candidate vanadium alloys.** Loomis, B.A.; Lee, R.H.; Smith, D.L.; Peterson, J.R. (Argonne National Lab., IL (USA); Teledyne-Wah Chang, Albany, OR (USA)). Sep 1987. Contract W-31109-ENG-38. 20p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88003051/JAW.

From 3. international conference on fusion reactor materials; Karlsruhe, F.R. Germany (4 Oct 1987).

The dependence of the yield strength, tensile strength, elongation, and reduction in area on temperature for the V-15Ti-7.5Cr, V-20Ti, V-15Cr-5Ti, V-12Cr-5Ti, V-10Cr-5Ti, and V-3Ti-1Si alloys was determined from tensile tests at temperatures ranging from 25 to 700°C. The strength of the alloys increased with an increase of the combined Cr and Ti concentration. The total elongation for the alloys ranged between 20% and 38%. The reduction in area ranged from 30% to 90%. The DBTT, which was determined from the temperature dependence of the reduction in area, was less than 25°C for the V-15Ti-7.5Cr, V-20Ti, and V-3Ti-1Si alloys. The DBTT for the V-10Cr-5Ti, V-12Cr-5Ti, and V-15Cr-5Ti alloys was also less than 25°C if these alloys were annealed to reduce the hydrogen concentration prior to the tensile test. If these latter alloys were not annealed prior to the tensile test, the DBTT ranged from 40°C to 90°C and the DBTT increased with an increase of the Cr concentration. A Cr/Ti concentration ratio of 0 to 0.5 in these alloys was found to cause the alloys to be less susceptible to hydrogen embrittlement. 14 refs., 4 figs., 3 tabs.

10499 **(CONF-871125—15-Rev.) Helium-ion-induced release of hydrogen from graphite.** Langley, R.A. (Oak Ridge National Lab., TN (USA)). 1987. Contract AC05-84OR21400. 12p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88002599/JAW.

From 34. national vacuum symposium and topical conference; Anaheim, CA, USA (2 Nov 1987).

The ion-induced release of hydrogen from AXF-5Q graphite was studied for 350-eV helium ions. The hydrogen was implanted into the graphite with a low energy (~200 eV) and to a high fluence. This achieved a thin (~10-nm), saturated near-surface region. The release of hydrogen was measured as a function of helium fluence. A model that includes ion-induced detrapping, retrapping, and surface recombination was used to analyze the experimental data. A value of (1.65 +- 0.2) x 10^{-16} cm^2 was obtained from the detrapping cross section, and a value of (0.5 to 4) x 10^{-14} cm^4/atoms was obtained for the recombination coefficient. 11 refs., 4 figs.

10500 **(CONF-8704230—1) Steady-state deformation of some lithium ceramics.** Poeppel, R.B.; Routbort, J.L.; Billone, M.C.; Applegate, D.S.; Buchmann, E.; Londschien, B. (Argonne National Lab., IL (USA)). May 1987. Contract W-31109-ENG-38. 15p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88003116/JAW.

From Symposium on fabrication and properties of lithium ceramics; Pittsburgh, PA, USA (26 Apr 1987).

The stress-strain behavior of Li_2O, $LiAlO_2$ and Li_2ZrO_3 polycrystals, with densities varying from 0.70 to 0.95 of the theoretical, has been measured in constant-crosshead-speed compression tests at temperatures of 700 to 1000°C with strain rates ranging from about 10^{-6} to 10^{-4} s^{-1}. A steady-state stress, σ/sub s/, for which the work-hardening rate becomes zero, was achieved. These results, therefore, yield information equivalent to that obtained from creep experiments. Limited data on $LiAlO_2$ and Li_2ZrO_3 were obtained. Nevertheless, under comparable conditions the lithium aluminate and zirconate were considerably stronger than the Li_2O. This finding may be related to differences in crystal structure. It is, however, likely that in operation as a function breeder blanket material, the oxide will swell whereas the aluminate and the zirconate will crack. 5 refs., 6 figs., 1 tab.

10501 **(CONF-8704230—2) Mathematical models for predicting tritium transport in lithium ceramics.** Billone, M.C. (Argonne National Lab., IL (USA)). Apr 1987. Contract W-31109-ENG-38. 26p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88003117/JAW.

From Symposium on fabrication and properties of lithium ceramics; Pittsburgh, PA, USA (26 Apr 1987).

Tritium retention and release data for lithium ceramics (Li_2O, $LiAlO_2$, and Li_4SiO_4) are available from in-reactor and post-irradiation anneal tests on single crystals, powders, and sintered products. With the exception of the single-crystal tests in which bulk diffusion is the rate-limiting release mechanism, it is very difficult to interpret the results of these tests and extrapolate the results to design conditions for a fusion solid-breeder blanket. Mathematical models are presented for various bulk, grain-boundary, and free-surface phenomena to aid in the interpretation and extrapolation of the data. 24 refs., 6 figs., 4 tabs.

10502 **(CONF-8706134—3) Measurement of long-lived isotopes in fusion materials.** Greenwood, L.R.; Bowers, D.L. (Argonne National Lab., IL (USA)). 1987. Contract W-31109-ENG-38. 15p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88003063/JAW.

From 6. ASTM/EURATOM symposium; Jackson Hole, WY, USA (1 Jun 1987).

Neutron cross section measurements are reviewed for the production of long-lived isotopes in fusion reactor materials. Samples were irradiated at 14.5 to 14.8 MeV at the RTNSII facility. Long-lived reaction products were detected using gamma and x-ray spectroscopy, liquid scintillation spectrometry, and accelerator mass spectrometry. Radiochemical separations were performed for many samples prior to analysis. Results are summarized for reactions leading to ^{26}Al (720,000 y), ^{53}Mn (3,700,000 y), ^{55}Fe (2.73 y), ^{63}Ni (100 y), ^{59}Ni (76,000 y), ^{91}Nb (700 y), and ^{94}Nb (20,300 y). 17 refs., 2 figs., 4 tabs.

10503 **(DOE/ER/40156—1) Heavy ion beam fusion theory and simulation: Annual report, October 1985 to 31 January 1987.** Haber, I. (Naval Research Lab., Washington, DC (USA)). 31 Jan 1987. Contract AI05-84ER40156. 23p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88003207/JAW.

A large number of simulations have been performed to establish a database of simulations for use in accelerator designs, and to compare the simulated emittance growths with the threshold for emittance growth actually measured in the Single Beam Transport Experiment (SBTE) at LBL. These simulations show substantial agreement with the experiment. They also extend into the parameter regime, where emittance growths are slower than could be measured in SBTE, but which may still be important to a driver system several times longer. Also demonstrated by these simulations, is that, even for beams which are not in detailed space-charge equilibrium and can therefore be subject to substantial nonlinear space-charge forces, emittance growths are restricted to what is consistent with energy conservation provided that the instability threshold is not crossed. This occurs even though energy need not be conserved in alternating gradient systems. Major modifications have been made to the two dimensional SHIFT-XY (Simulation of Heavy Ion Fusion Transport) code to add some of the three-dimensional physics associated with the transverse variation of the longitudinal fields in a long beam. Enhancements to the code have also been implemented which can decrease running times as much as 30% for typical parameters. 13 refs., 7 figs.

10504 **(DOE/ER/52140—1) Fusion system design: Progress report, November 15, 1986-November 14, 1987.** Kulcinski, G.L.; Emmert, G.A.; Santarius, J.F.; Sawan, M.E. (Wisconsin Univ., Madison (USA)). Nov 1987. Contract FG02-87ER52140. 8p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88002268/JAW.

The paper discusses progress in the system design of the Tiber-II tokamak. In particular, topics discussed are neutronics analysis; thermal hydraulics analysis; activation analysis; LOCA and LOFA analysis; D/He-3 operation on Tiber-II; and a scoping design study of a D/He Tandem mirror reactor. (LSP)

10505 **(DOE/ET/51013—236) Operating large controlled thermonuclear fusion research facilities.** Gaudreau, M.P.J.; Tarrh, J.M.; Post, R.S.; Thomas, P. (Massachusetts Inst. of Tech., Cambridge (USA). Plasma Fusion Center). Oct 1987. Contract AC02-78ET51013. 9p. (PFC/CP—87-17; CONF-871007—64). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88002591/JAW.

From 12. symposium on fusion engineering; Monterey, CA, USA (12 Oct 1987).

The MIT Tara Tandem Mirror is a large, state of the art controlled thermonuclear fusion research facility. Over the six years of its design, implementation, and operation, every effort was made to minimize cost and maximize performance by using the best and latest hardware, software, and scientific and operational techniques. After reviewing all major DOE fusion facilities, an independent DOE review committee concluded that the Tara operation was the most automated and efficient of all DOE facilities. This paper includes a review of the key elements of the Tara design, construction, operation, management, physics milestones, and funding that led to this success. We emphasize a chronological description of how the system evolved from the proposal stage to a mature device with an emphasis on the basic philosophies behind the implementation process. This description can serve both as a qualitative and quantitative database for future large experiment planning. It includes actual final costs and manpower spent as well as actual run and maintenance schedules, number of data shots, major system failures, etc. The paper concludes with recommendations for the next generation of facilities. 13 refs., 15 figs., 3 tabs.

10506 **(DOE/ET/51013—237) Lessons learned from the MIT Tara control and data system.** Gaudreau, M.P.J.; Sullivan, J.D.; Fredian, T.W.; Irby, J.H.; Karcher, C.A.; Rameriz, R.A.; Sevillano, E.; Stillerman, J.A.; Thomas, P. (Massachusetts Inst. of Tech., Cambridge (USA). Plasma Fusion Center). Oct 1987. Contract AC02-78ET51013. 6p. (PFC/CP—87-18; CONF-871007—65). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88002592/JAW.

From 12. symposium on fusion engineering; Monterey, CA, USA (12 Oct 1987).

The control and data system of the MIT Tara Tandem Mirror has worked successfully throughout the lifetime of the experiment (1983 through 1987). As the Tara project winds down, it is appropriate to summarize the lessons learned from the implementation and operation of the control and data system over the years and in its final form. The control system handled ~2400 I/0 points in real time throughout the 5 to 10 minute shot cycle while the data system, in near real time, handled ~1000 signals with a total of 5 to 7 Mbytes of data each shot. The implementation depended upon a consistent approach based on separating physics and engineering functions and on detailed functional diagrams with narrowly defined cross communication. This paper is a comprehensive treatment of the principal successes, residual problems, and dilemmas that arose from the beginning until the final hardware and software implementation. Suggestions for future systems of either similar size or of larger scale such as CIT are made in the conclusion. 11 refs., 1 fig.

10507 **(EUR—10659) Oak ridge test matrix no. 5B and 5C HFR and HFIR irradiations and post-irradiation tensile tests in support of fusion reactor first wall material development.** Van Der Schaaf, B.; Grossbeck, M.; Scheurer, H. (Duct Energy Research Foundation, ECN, Petten, Netherlands; Oak Ridge National Laboratory, ORNL, TN, USA). (Commission of the European Communities, Petten (Netherlands). Joint Nuclear Research Center; Commission of the European Communities, Luxembourg). 1986. 112p. NTIS (US Sales Only), PC A06/MF A01. Order Number DE88751582/JAW.

In the frame of an "IEA Implementing Agreement" between Canada, the EC, Japan, the US and Switzerland, a research and development programme on radiation damage on fusion reactor materials is performed. Annex II of the above agreement defines a series of joint (EC-US-Japan) fusion material irradiations in various MTR's. The present report describes the irradiation device, the irradiation history, the post-irradiation tensile tests, together with comments on the results of these PIE tests, of two of the above irradiations, corresponding to experiments 5B and 5C of the "Oak Ridge Matrix". The alloys included were the following: - European Reference AISI316L ("EC316") - US reference AISI 316L ("US316") - US P.C.A. ("US-PCA") - Japanese P.C.A (J-PCA).

10508 **(EUR-CEA-FC—1327) From guided to optical microvave propagation.** Rebuffi, L. (Association Euratom-CEA, Centre d'Etudes Nucleaires de Cadarache, 13 - Saint-Paul-lez-Durance (France). Dept. de Recherches sur la Fusion Controlee). May 1987. 124p. NTIS (US Sales Only), PC A06/MF A01. Order Number DE88751603/JAW.

A wide theoretical study on quasi-optical microwave propagation has been carried out in the range 3 GHz - 300 GHz. A high power TEMOO Gaussian beam can be propagated for long distances with low losses if a nearly-confocal system of mirrors is used as phase corrector. The theory of beam waveguides using elliptic paraboloidal reflectors has been critically revisited and developed. All the kind of losses (diffraction, matching, truncation, divergence, ohmic, atmospheric, depolarization, misalignment) have been examinated into detail. Criteria to find the best design parameters of a quasi-optical transmission line are given once the frequency, the power and the available room are known. In general, a well designed Reflecting Beam Waveguide should permit the propagation of several MW in CW without a sensible beam shape deformation, and with total losses of about a fraction of % in 10 meters. Several examples at different frequencies are herein reported, and applications to high power Electron Cyclotron Heating and Lower Hybrid Heating of a plasma find a good solution using quasi-optical schemes. The wide bandwidth, the fact of having a single line needing no cooling and without requirements of high mechanical precision (as in certain waveguide components at high frequency), are other advantages of the Reflecting Beam Waveguide System (RBWS) which have been examined in this work.

10509 **(IAE—4335/6) Magnetic system of an axially-symmetric open trap.** Golovin, I.N.; Poletaev, D.L.; Khvesyuk, V.I.; Shabrov, N.V. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii). 1986. 12p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88700851/JAW.

The main requirements to magnetic system of axially-symmetric magnetic trap, intended for studying flute instability of ion-hot plasma, filling the magnetic trap with the help of additional stabilizing cells, connected to the both of its cones, in the form of cusps, filled by electron-hot plasma, are formulated. The search for an optimal variant of the trap magnetic system was conducted empirically. A large number of variants was considered, differing from each other in the shape, dimensions and relative position of magnet coils. It is shown, that in order to allow passage of 0.3-0.5 W magnetic flux from loading cell into cusp, the cusp magnet internal diameter should be sufficiently large. Application of copper windings cooled by liquid nitrogen, appears to be the optimal variant for producing maximal magnetic fields. 11 refs.; 7 figs.

10510 **(INIS-BR—907) Equilibrium vertical field in the TBR Tokamak.** Ueta, A.Y. (Sao Paulo Univ. (Brazil). Inst. de Fisica). 1985. 84p. (In Portuguese). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88700876/JAW.

An experimental study on the influence of the vertical magnetic field of the TBR tokamak on the stability and equilibrium of plasma column, was done. Magnetic pick-up coils were built to measure plasma current and position, together with active networks, necessary fo the electronic processing of signals. Some measurements were on the space configuration of the vertical field, and on the influence due to the toroidal vessel. From the data obtained it was possible to discuss the influence of the currents induced on the vessel surface, on plasma equilibrium. Theoretical and experimental results of the vertica field, as a function of plasma current were compared, and allowed an evaluation of the plasma kinetic pressure and temperature.

10511 (INIS-mf—11054, pp 11) **Myon-induced processes in hydrogen. Weak interactions and cold fusion.** Cargnelli, M. (Oesterreichische Akademie der Wissenschaften, Vienna). Sep 1987. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88700772/JAW. (CONF-8709196—).

From Annual convention fo the Austrian Physical Society; Vienna, Austria (21 Sep 1987).

10512 (INIS-mf—11054, pp 35) **Potential of low-tritium fuel mixtures in fusion reactor with magnetic confinement.** Kernbichler, W. (Technische Univ., Graz, Austria. Inst. fuer Theoretische Physik und Reaktorphysik). Sep 1987. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88700772/JAW. (CONF-8709196—).

From Annual convention fo the Austrian Physical Society; Vienna, Austria (21 Sep 1987).

10513 (INIS-mf—11054, pp 35) **Nuclear Cross Section Compilation for Advanced Fusion Fuel Research.** Feldbacher, R. (Technische Univ., Graz, Austria. Inst. fuer Theoretische Physik und Reaktorphysik). Sep 1987. NTIS (US Sales Only), PC A05/MF A01. Order Number DE88700772/JAW. (CONF-8709196—).

From Annual convention fo the Austrian Physical Society; Vienna, Austria (21 Sep 1987).

10514 (INIS-mf—11054, pp 36) **Preliminary Assessment of the Prospects of Nuclear Fusion and Fission as Viable Power Sources.** Molin, A.; Heindler, M.; Kernbichler, W. (Technische Univ., Graz, Austria. Inst. fuer Theoretische Physik und Reaktorphysik). Sep 1987. NTIS (US Sales Only), PC A05/MF A01. Order Number DE88700772/JAW. (CONF-8709196—).

From Annual convention fo the Austrian Physical Society; Vienna, Austria (21 Sep 1987).

10515 (INIS-mf—11054, pp 36) **Muon-catalyzed nuclear fusion in very cold D-T mixtures.** Ackerbauer, P.; Breunlich, W.H.; Cargnelli, M.; Jeitler, M.; Kammel, P.; Marton, J.; Naegele, N.; Scrinzi, A.; Werner, J.; Zmeskal, J. (Oesterreichische Akademie der Wissenschaften, Vienna). Sep 1987. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88700772/JAW. (CONF-8709196—).

From Annual convention fo the Austrian Physical Society; Vienna, Austria (21 Sep 1987).

10516 (INIS-mf—11054, pp 68) **Muon-catalyzed D/T fusion investigations in the low temperature range.** Ackerbauer, P.; Breunlich, W.; Cargnelli, M.; Jeitler, M.; Kammel, P.; Marton, J.; Naegele, N.; Scrinzi, A.; Werner, J.; Zmeskal, J. (Oesterreichische Akademie der Wissenschaften, Vienna). Sep 1987. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88700772/JAW. (CONF-8709196—).

From Annual convention fo the Austrian Physical Society; Vienna, Austria (21 Sep 1987).

10517 **(IPF—87-1) Optimization of mode converters for generating the fundamental TE/sub 01/ mode from TE/sub 06/ gyrotron output at 140 GHz.** Kumric, H.; Thumm, M.; Wilhelm, R. (Stuttgart Univ. (Germany, F.R.). Inst. fuer Plasmaforschung). Mar 1987. 35p. Stuttgart Univ., Germany, F.R. Inst. fuer Plasmaforschung.

Oversized high-power mode converters were designed to transform the TE/sub 06/ output mode of a 140 GHz gyrotron into the fundamental circular symmetric TE/sub 01/ mode for low-loss propagation and further conversion to the perfectly linearly polarized quasi-optical HE/sub 11/ hybrid mode. The improved perturbation structures of the rippled-wall mode converters (with input- and output diameter D = 27.8 mm) were optimized by numerically integrating the proper coupled-wave differential equations. Three types of mode transformation schemes have been investigated: (1) step-by-step TE/sub 06/->TE/sub 05/->TE/sub 04/->TE/sub 03/->TE/sub 02/->TE/sub 01/ conversion, (2) direct TE/sub 06/->TE/sub 01/ conversion, (3) two-step TE/sub 06/->TE/sub 04/->TE/sub 01/ conversion. In all three cases the predicted conversion efficiency is approximately 98%. The type (1) transducer exhibits a relatively broad bandwidth but is very long (total length L = 4.2 m) whereas the type (2) transformer is short (L = 1.8 m) but has an extremely narrow bandwidth. The two-step converter (3) realizes a compromise with respect to bandwidth. The low-power experimental data for conversion scheme (1) at frequencies around 70 and 150 GHz are in excellent agreement with corresponding computed values.

10518 **(IPF—87-2) Wavenumber spectrometer - an alternative to the directional coupler for multimode analysis in oversized waveguides.** Kasparek, W.; Mueller, G.A. (Stuttgart Univ. (Germany, F.R.). Inst. fuer Plasmaforschung). Mar 1987. 30p. Stuttgart Univ., Germany, F.R. Inst. fuer Plasmaforschung.

The problem of measuring a broad spectrum of discrete modes in oversized waveguides is discussed. An analysis of the standard solution, the directional coupler, shows that the measured signals can be ambiguous in mode selectivity and directivity. Therefore we have developed an instrument, the wavenumber spectrometer, where this problem of ambiguity is avoided. The principle of this new instrument ensures extremely high directivity and allows the measurement of all TE and TM modes with the same instrument. Furthermore, the device inherently has a large frequency bandwidth. This wavenumber spectrometer consists of a leaky-wave antenna structure in the wall of the waveguide and of a movable receiver antenna with high directivity. From the radiation pattern of the leaky-wave antenna, as measured by the receiver antenna, the spectrum of the modes propagating in the waveguide is deduced.

10519 **(IPF—87-3) Mode purity measurements on gyrotrons for plasma heating at the stellarator W VII-AS.** Barkley, H.J.; Kasparek, W.; Kumric, H.; Mueller, G.A.; Schueller, P.G.; Thumm, M.; Wilhelm, R.; Erckmann, V. (Stuttgart Univ. (Germany, F.R.). Inst. fuer Plasmaforschung; Max-Planck-Institut fuer Plasmaphysik, Garching (Germany, F.R.)). Mar 1987. 18p. Stuttgart Univ., Germany, F.R. Inst. fuer Plasmaforschung.

For electron cyclotron resonance heating of plasmas in the stellarator W VII-AS, high-power microwave sources with high mode purity are needed. Therefore, the mode compositions of four commercial 200 kW/70 GHz gyrotrons, specified for this project, were analyzed with a wavenumber spectrometer. The measurements confirm the specified spurious mode content of less than 10%.

10520 **(IPPJ—828) Fast wave injection into high temperature tokamak plasmas in the lower-hybrid-density regime of JIPP T-IIU.** Toi, K.; Hamada, Y.; Ohkubo, K. (Nagoya Univ. (Japan). Inst. of Plasma Physics). May 1987. 30p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88751044/JAW.

Hard X-ray emission (30 < approx E < approx 200 keV) and suprathermal electron cyclotron emission are enhanced for density up to anti n/sub e/ ~ 1.8 x 10/sup 13/ cm/sup -3/ (n/sub eo/ ~ 2.3 x 10/sup 13/ cm/sup -3/) by launching fast waves of 800 MHz into high temperature tokamak plasmas (T/sub eo/ > approx 1 keV) in the regime of lower hybrid resonance density (1.3 > approx f/sub o//f/sub LH/(0) > approx 0.9) on JIPP T-IIU. The observed radial profile of the hard X-ray emission indicates that the suprathermal electrons are localized near the plasma axis (r/a/sub L/ < approx 0.4; a/sub L/: limiter radius), which is confirmed by the data obtained from a soft X-ray detector array and a high resolution crystal spectrometer. In the typical case of anti n/sub e/ ~ 1.3 - 1.5 x 10/sup 13/ cm/sup -3/ with phase differences between adjacent antennas Δphi = +60 deg, the rf power absorbed by the suprathermal electrons is about 15 % of the net injected rf power. The absorption rate is consistent with that of Landau damping on suprathermal electrons which pre-exist in a target plasma. The increment of the suprathermal electron density corresponds to an rf driven current of ~ 25 kA, if the effective energy of the electrons is assumed to be 50 keV. The dependences of the increment of total radiation and the amplitude of a lower side band (f = f/sub o/ - f/sub ci/) on the phase difference Δphi agree well with the linear theory on fast wave coupling and propagation. The experimental data are also compared with preliminary results of slow wave injection into a similar target plasma.

10521 **(JAERI-M—87-091) Conceptual design study of fusion experimental reactor (FY86 FER). Plant system design.** Saito, Ryusei; Kashihara, Shin-ichiro; Itoh, Shin-ichi. (Japan Atomic Energy Research Inst., Tokyo). Aug 1987. 386p. (In Japanese). NTIS (US Sales Only), PC A17/MF A01. Order Number DE88751070/JAW.

This report describes the results of conceptual design study on plant systems for the Fusion Experimental Reactor (FY86 FER). Design studies for FER plant systems have been continued from FY85, especially for design modifications made in accordance with revisions of plasma scaling parameters and system improvements. This report describes 1) system construction, 2) site and reactor building plan, 3) repaire and maintenance system, 4) tritium circulation system, 5) heating, ventiliation and air conditioning system, 6) tritium clean-up system, 7) cooling and baking system, 8) waste treatment and storage system, 9) control system, 10) electric power system, 11) site factory plan, all of which are a part of FY86 design work. The plant systems described in this report generally have been based on the FY86 FER (ACS Reactor) which is an one of the six candidates for FER.

10522 **(JAERI-M—87-102) Development of tokamak reactor automated design code 'TRADE'.** Nishio, Satoshi; Tsunematsu, Toshihide; Tone, Tatsuzo; Kasai, Masao; Nishikawa, Masana. (Japan Atomic Energy Research Inst., Tokyo). Jul 1987. 45p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88751064/JAW.

This report describes Tokamak Reactor Automated Design Code "TRADE" which has been developed in order to assess the impact of the design choices on reactor systems and to find out the optimum design concept through wide parameter range. The optimum design concept is realized by finding out the optimum compromise between the plasma performance, the torus structure and the coil systems. Furthermore, TRADE code is for producing an input data set into TORSAC which had already been developed for a sensitivity analysis.

10523 **(JAERI-M—87-106) Comparison of NBI current drive theory with experiment and requirements for extrapolation to next step devices. Conceptual design study of FY86 FER.** Okano, Kunihiko; Yamamoto, Shin; Sugihara, Masayoshi. (Japan Atomic Energy Research Inst., Tokyo). Aug 1987. 19p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88751054/JAW.

The exactness of the present beam current drive theory was investigated by comparing between a numerical simulation and an experimental value. Ambiguities in the present beam current drive theory are also discussed. In order to estimate the potential of the NBI current driver in next generation tokamaks, the current-drive efficiency is calculated with INTOR parameters. Drive efficiency is nearly at the level of the r.f. current driver.

10524 **(JAERI-M—87-107) INTOR scoping study. Conceptual design study of FY86 FER.** Kasai, Masao; Ida, Toshio; Nishikawa, Masana; Kameari, Akihisa; Iida, Hiromasa; Fujisawa, Noboru. (Japan Atomic Energy Research Inst., Tokyo). Aug 1987. 33p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88751057/JAW.

The INTOR Scoping Study was performed by using the new-TORSAC which was developed from TORSAC (TOkamak Reactor Systems Analysis Code). The ASDEX type tau/sub E/ scaling was used in this scoping studies. The difference of the possible burn time between quasi-steady state and inductive operation scenario decreases with increasing plasma elongation and triangularity. The maximum stored energy, total PF coil Ampere turn and the capital cost are less in single-null divertor case than in double-null divertor one. The effect of increasing toroidal field is not expected to be large. The capital cost has a weak minimum point at plasma elongation of 1.8 ~ 1.9 in the case of adopting radial access at reactor maintenance. The capital cost of inductive operation reactor is expected to be higher than quasi-steady state operation one by approximately 2 ~ 4 %. No clear merit can be expected by using ergodic limiter concept since the ergodic region increases machine size. The capital cost can be significantly reduced (10 ~ 20 %) by adopting steady state operation scenario, though the energy multiplication factor and wall loading would be low compared with other operation scenario.

10525 **(JAERI-M—87-108) Plasma physics design and major specifications of candidate reactors for FER design studies. Conceptual design study of FY86 FER.** Sugihara, Masayoshi; Mizoguchi, Tadanori; Hatayama, Akiyoshi. (Japan Atomic Energy Research Inst., Tokyo). Aug 1987. 54p. (In Japanese). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88751066/JAW.

Physics design and reference options of FER (Fusion Experimental Reactor) for FY86 conceptual design study are presented. As for physics design, emphases are placed on the data base, from which physics design constraints different from those of FY84 and 85, have been derived. Wide parametric studies are done for the cost-effectiveness to select the reference options. They are (i) reduction of volt center dot second, (ii) noncircularity, (iii) shield thickness, (iv) magnet design constraints, (v) partial usage of normal conducting OH coils, (vi) impact of the access method to the reactor core component on the capacity of PF coil system. Based on these studies, various system quantities are evaluated and five reference options are selected. Reference options for FY86 conceptual design consist of these options in addition to the NBI reactor.

10528 **(JAERI-M—87-111) Conceptual design study of fusion experimental reactor (FY86 FER). Safety.** Seki, Yasushi; Iida, Hiromasa; Honda, Tsutomu. (Japan Atomic Energy Research Inst., Tokyo). Aug 1987. 240p. (In Japanese). NTIS (US Sales Only), PC A11/MF A01. Order Number DE88751071/JAW.

This report describes the study on safety for FER(Fusion Experimental Reactor) which has been designed as a next step machine to the JT-60. Though the final purpose of this study is to have an image of design base accident, maximum credible accident and to assess their risk or probability, etc., as FER plant system, the emphasis of this years study is placed on fuel-gas circulation system where the tritium inventory is maximum. This report consists of two chapters. The first chapter of this report summaries the FER system and describes FMEA(Failure Mode and Effect Analysis) and related accident progression sequence for FER plant system as a whole. The second chapter of this report is focused on fuel-gas circulation system including the purification, isotope separation system and storage system. Here, probability of risk is assessed by the probabilistic risk analysis (PRA) procedure based on FMEA, ETA and FTA.

10527 **(JAERI-M—87-119) Two-dimensional analysis for a scrapeoff and divertor regions with an MHD model. Conceptual design study of FY86 FER.** Ueda, Noriaki; Kasai, Masao; Hitoki, Shigehisa. (Japan Atomic Energy Research Inst., Tokyo). Aug 1987. 22p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88751069/JAW.

With a two-dimensional time dependent fluid code for transport processes in the edge plasma in a tokamak, coupled with Monte-Carlo method for neutral gas behavior, preliminary numerical study has been carried out for the FER divertor. Design base data such as energy flux, particle flux and so on which are essentially important to make an divertor design reliable have been obtained.

10528 (LA—1139-C, pp 433-441) **Engineering features of the Madison Symmetric Torus.** Dexter, R.N.; Kerst, D.W.; Lovell, T.W.; Prager, S.C.; Sprott, J.C. (Univ. of Wisconsin, Madison). Nov 1987. NTIS, PC A27. Order Number DE88001915/JAW. (CONF-8707105—).

From International workshop on engineering design of next step reversed field pinch devices; Los Alamos, NM, USA (13 Jul 1987).

We describe the design parameters, unconventional features, and status of the Madison Symmetric Torus, MST, an RFP now approaching completion. A desire to minimize field errors dominated the design, leading to flanged gaps and inclusion of a pumping duct with small pump ports into the shell. No liner was to be used in the initial configuration, the versatile aluminum shell being the vacuum containment vessel (VCV). Simplified access to the inside of the vacuum vessel was accomplished by using the tank itself as single-turn poloidal as well as single-turn toroidal field coil. Thus none of the familiar toroidal or poloidal field coil sets surround the tank. A girder structure has been installed to permit removing the core-keeper and top-half of the vacuum vessel for insertion of internal shells or liners. More routinely, we intend to lift core-keeper and top half of the VCV together for entry of personnel into the VCV for changes of internal diagnostics or limiting surfaces, or for installation of movable limiters, etc. All structural features were designed to ease disassembly. 5 figs.

10529 (LA—1139-C, pp 443-454) **Laminated beam analysis.** Hill, J. (Los Alamos National Lab., NM). Nov 1987. NTIS, PC A27. Order Number DE88001915/JAW. (CONF-8707105—).

From International workshop on engineering design of next step reversed field pinch devices; Los Alamos, NM, USA (13 Jul 1987).

Finite element analysis is used to determine the response of two beams which are identical in every respect except internal construction. One beam is a laminated beam with discrete materials. The other is modeled as a single material beam with material properties chosen to mimic the response of the laminated beam. The results of the two analyses are compared directly and indirectly by using the single material beam to predict the stress state of the laminated beam. The technique of using a single material to represent several materials is shown to be useful when the analyst uses care in interpreting the results. 7 figs.

10530 (LA—1139-C, pp 455-467) **Numerical analyses of eddy current and error field for RFP [Reversed Field Pinch] by "INCANET".** Suzuki, N.; Uesaka, M.; Saitoh, K.; Yoshida, Z.; Inoue, N. (Ishikawajima-Harima Heavy Industries Co., Ltd., Tokyo, Japan; Univ. of Tokyo, Japan). Nov 1987. NTIS, PC A27. Order Number DE88001915/JAW. (CONF-8707105—).

From International workshop on engineering design of next step reversed field pinch devices; Los Alamos, NM, USA (13 Jul 1987).

Numerical analyses of eddy current and resulted error field for RFP chamber are presented. The computer code named 'INCANET' uses a network mesh method. It was confirmed that the eddy current induced in a vacuum chamber tends to flow in the inner part of the torus chamber. The component of eddy current flowing around vertical port holes generates about two times stronger error field than that at no-hole location. 9 figs.

10531 (LA—1139-C, pp 469-475) **Stress analysis of poloidal field coils for ZTH machine.** Girrens, S.P.; Bennett, J.G. (Los Alamos National Lab., NM). Nov 1987. NTIS, PC A27. Order Number DE88001915/JAW. (CONF-8707105—).

From International workshop on engineering design of next step reversed field pinch devices; Los Alamos, NM, USA (13 Jul 1987).

Three-dimensional finite element analysis of representative poloidal field (PF) coils for the Los Alamos CPRF/ZTH air core machine is being performed to determine static stress levels developed within the coil structure due to Lorentz-force loading. Magnetic fields for ZTH are produced, in part, by 18 PF coils (10 ohmic heating and 8 equilibrium field). The PF coils are made with copper conductors separated by epoxy insulation. The PF coils are supported by 16, equally spaced, 4.0-in. thick, radial G-10 bulkheads. This paper summarizes the computational procedures used in the analysis and presents coil stress results obtained to date. 4 figs., 1 tab.

10532 (LA—1139-C, pp 477-481) **Higher power closing switch.** Ogawa, K.; Shimada, T.; Hirano, Y.; Yagi, Y.; Oyabu, I.; Yamaguchi, S.; Yamane, Y. Nov 1987. NTIS, PC A27. Order Number DE88001915/JAW. (CONF-8707105—).

From International workshop on engineering design of next step reversed field pinch devices; Los Alamos, NM, USA (13 Jul 1987).

The high power closing switch system has been developed for the power supply system in the TPE-1RM15. This switch has the metal contacts, therefore, the number of coulombs which pass through the switch is very large as compared with an arc switch like the ignitron. The contact should be moved fast to use as a start switch. One problem is related to the jitter and another is arc problems generated between the contacts caused by the chattering. The arc damage reduces the life time of the switch. The characteristics of this switch is introduced in this memo. 3 figs., 1 tab.

10533 (LA—1139-C, pp 483-493) **RFP physics workshop.** Schoenberg, K.; Weber, P. Nov 1987. NTIS, PC A27. Order Number DE88001915/JAW. (CONF-8707105—).

From International workshop on engineering design of next step reversed field pinch devices; Los Alamos, NM, USA (13 Jul 1987).

The purpose of the physics workshop was to focus on plasma physics issues that drive RFP engineering design in both present and future experiments. Thirteen total papers were given at the formal and workshop sessions. The material presented was categorized into three major subjects: field errors, shell effects, and required plasma environment to insure performance. A summary of these subjects, and how they relate to RFP engineering design is given in this report.

10534 (LA—1139-C, pp 495-498) **Front-end workshop.** Weldon, D.M. Nov 1987. NTIS, PC A27. Order Number DE88001915/JAW. (CONF-8707105—).

From International workshop on engineering design of next step reversed field pinch devices; Los Alamos, NM, USA (13 Jul 1987).

Papers were presented describing aspects of three new machines in various stages of design or construction: The Madison Symmetric Torus at the University of Wisconsin, TPE-RX at Tanashi, and ZTH at Los Alamos. Workshop discussions touched on many features of RFX also. This report contains summaries of those papers.

10535 (LA—1139-C, pp 499-500) **Magnetics workshop.** Stella, A. Nov 1987. NTIS, PC A27. Order Number DE88001915/JAW. (CONF-8707105—).

From International workshop on engineering design of next step reversed field pinch devices; Los Alamos, NM, USA (13 Jul 1987).

This paper is a summary of talks presented concerning magnets and magnetic fields in reverse field pinches. (JDH)

10536 (LA—1139-C, pp 501) **Electrical design workshop.** Maschio, A. Nov 1987. NTIS, PC A27. Order Number DE88001915/JAW. (CONF-8707105—).

From International workshop on engineering design of next step reversed field pinch devices; Los Alamos, NM, USA (13 Jul 1987).

This summary covers topics of interest to reverse field pinch power supply designers. (JDH)

10537 (LA—11139-C) **Proceedings of the international workshop on engineering design of next step reversed field pinch devices.** Thomson, D.B. (comp.). (Los Alamos National Lab., NM (USA)). Nov 1987. Contract W-7405-ENG-36. 486p. (CONF-8707105—). NTIS, PC A21. Order Number DE88001915/JAW.

From International workshop on engineering design of next step reversed field pinch devices; Los Alamos, NM, USA (13 Jul 1987).

These Proceedings contain the formal contributed papers, the workshop papers and workshop summaries presented at the International Workshop on Engineering Design of Next Step RFP Devices held at Los Alamos, July 13-17, 1987. Contributed papers were presented at formal sessions on the topics: (1) physics overview (3 papers); (2) general overview (3 papers); (3) front-end (9 papers); (4) computer control and data acquisition (1 paper); (5) magnetics (5 papers); and (6) electrical design (9 papers). Informal topical workshop sessions were held on the topics: (1) RFP physics (9 papers); (2) front-end (7 papers); (3) magnetics (3 papers); and (4) electrical design (1 paper). This volume contains the summaries written by the Chairmen of each of the informal topical workshop sessions. The papers in these Proceedings represent a significant review of the status of the technical base for the engineering design of the next step RFP devices being developed in the US, Europe, and Japan, as of this date.

10538 (LA—11139-C, pp 17-21) **STP-4 project.** Sato, K.I.; Masamune, S.; Yamada, S.; Arimoto, H.; Nagata, A.; Tamaru, T. (Nagoya Univ., Japan; Kyoto Institute of Technology, Japan; Hiroshima Univ., Japan). Nov 1987. NTIS, PC A27. Order Number DE88001915/JAW. (CONF-8707105—).

From International workshop on engineering design of next step reversed field pinch devices; Los Alamos, NM, USA (13 Jul 1987).

This paper briefly describes the design and experimental goals of the STP-4 project. Experiments are planned to further understand plasma behavior in reverse field pinch devices. The machine described here is expected to be part of US-Japan and EC-Japan collaborations. 7 refs., 3 figs. (JDH)

10539 (LA—11139-C, pp 23-49) **Physics rationale for the engineering specifications for ZTH.** DiMarco, J.N. (Los Alamos National Lab., NM). Nov 1987. NTIS, PC A27. Order Number DE88001915/JAW. (CONF-8707105—).

From International workshop on engineering design of next step reversed field pinch devices; Los Alamos, NM, USA (13 Jul 1987).

This report presents the physics rationale that established the engineering design of ZTH. The physics criteria are given and the implications regarding the engineering design are presented. Experimental and theoretical background evidence is given in support of the criteria. In the interests of controlling the length of this report the physics criteria to be discussed here are limited to the ones deemed to be of highest engineering priority. The issues treated are: (1) aspect ratio; (2) beta ratio; (3) current magnitude; (4) current rise-time; (5) field errors; (6) internal inductance; (7) liner resistance; (8) major and minor radii; (9) voltages; (10) volt-second rating; (11) wall-load limits. The issues and physics criteria are not presented in a mathematically closed fashion. The process of developing the physics criteria is a complicated procedure; constraints related to available resources are involved in the process, but are not discussed here. The final engineering specifications are the result of an intricate interplay of physics requirements coupled with engineering constraints. The values presented here represent an intense effort on the part of the ZTH Technical Steering Committee to determine priorities and resolve the issues. 32 refs., 8 figs.

10540 (LA—11139-C, pp 51-64) **Overview of CPRF/ZTH and the CPRF construction program.** Thullen, P. (Los Alamos National Lab., NM). Nov 1987. NTIS, PC A27. Order Number DE88001915/JAW. (CONF-8707105—).

From International workshop on engineering design of next step reversed field pinch devices; Los Alamos, NM, USA (13 Jul 1987).

The CPRF construction program includes the base facility and the initial experiment, ZTH. In ZTH the confinement properties of the RFP magnetic field configuration will be studied in support of the establishment of the scientific base for fusion energy. ZTH consists of a vacuum liner, limiters and/or wall armor, equilibrium shell, toroidal field coils, poloidal field coils, support structure, and other components required to establish desired plasma conditions in a 4-MA RFP fusion experiment. The remainder of CPRF includes control and data acquisition systems, vacuum and fueling systems, diagnostics, buildings, and electrical energy storage and power systems to drive the toroidal and poloidal coils. 4 figs., 2 tabs.

10541 (LA—11139-C, pp 65-74) **RFX experiment layout.** Fellin, L. (Universita di Padova, Italy). Nov 1987. NTIS, PC A27. Order Number DE88001915/JAW. (CONF-8707105—).

From International workshop on engineering design of next step reversed field pinch devices; Los Alamos, NM, USA (13 Jul 1987).

The layout of the buildings forming the site of the RFX experiment is described. The main features concerning the grounding system (both for the safety and for the operation of the machine) are discussed together with those of the screening system for the diagnostics and control areas. 6 figs.

10542 (LA—11139-C, pp 75-80) **Overview of REPUTE-2 project.** Miyamoto, K.; Inoue, N. (Univ. of Tokyo, Japan). Nov 1987. NTIS, PC A27. Order Number DE88001915/JAW. (CONF-8707105—).

From International workshop on engineering design of next step reversed field pinch devices; Los Alamos, NM, USA (13 Jul 1987).

This paper presents some specifications for the magnet coils of the REPUTE-2 project. REPUTE-2 is a reverse field pinch machine that will be used to investigate plasma production. 2 figs. (JDH)

10543 (LA—11139-C, pp 81-85) **Overview of the ZTH front-end design.** Weldon, D.M. (Los Alamos National Lab., NM). Nov 1987. NTIS, PC A27. Order Number DE88001915/JAW. (CONF-8707105—).

From International workshop on engineering design of next step reversed field pinch devices; Los Alamos, NM, USA (13 Jul 1987).

The front-end of ZTH is defined as the vacuum liner, graphite armor, and conduction shell. This paper gives a brief overview of the present ZTH front-end design and the reasons for selecting various features of the design. 4 figs.

10544 (LA—11139-C, pp 87-90) **Design study of REPUTE-2 machine.** Itou, Y. Nov 1987. NTIS, PC A27. Order Number DE88001915/JAW. (CONF-8707105—).

From International workshop on engineering design of next step reversed field pinch devices; Los Alamos, NM, USA (13 Jul 1987).

10545 (LA—11139-C, pp 91) **Construction of TPE - 1RM15 reversed field pinch in ETL (video tape presentation), October-December 1985.** Nov 1987. NTIS, PC A27. Order Number DE88001915/JAW. (CONF-8707105—).

From International workshop on engineering design of next step reversed field pinch devices; Los Alamos, NM, USA (13 Jul 1987).

10546 (LA—11139-C, pp 93-97) **CPRF/ZTH toroidal conducting shell design and fabrication considerations.** Ballard, E.L.; Smith, R.L.; Weldon, D.M. (Los Alamos National Lab., NM). Nov 1987. NTIS, PC A27. Order Number DE88001915/JAW. (CONF-8707105—).

From International workshop on engineering design of next step reversed field pinch devices; Los Alamos, NM, USA (13 Jul 1987).

This paper presents specifications and tolerances for the construction of a reverse field pinch machine to be built as part of the ZTH experiment. 3 figs. (JDH)

10547 (LA—11139-C, pp 99-103) **Design of the ZTH vacuum liner.** Prince, P.P. (Los Alamos National Lab., NM). Nov 1987. NTIS, PC A27. Order Number DE88001915/JAW. (CONF-8707105—).

From International workshop on engineering design of next step reversed field pinch devices; Los Alamos, NM, USA (13 Jul 1987).

The current status of the ZTH vacuum liner design is covered by this report. ZTH will be the first experiment to be installed in the CPRF (Confinement Physics Research Facility) at the Los Alamos National Laboratory and is scheduled to be operational at 2 MA in 1990 and at the rated current of 4 MA in 1992. The vacuum vessel has a 2.4m major radius and a 40 cm minor radius. The vacuum vessel design features which satisfy the operating parameters are defined. The liner is constructed of Inconel 625 and has a geometry which alternates sections of thin walled bellows with rigid ribs. These composite sections span between pairs of the 16 diagnostic stations to complete the torus. The thin bellows sections maximize the liner toroidal resistance and the ribs provide support and positional accuracy for the armour in relation to the conducting shell. Heat transfer from the vessel is controlled by a blanket wrap of ceramic fiber insulation and the heat flux is dissipated to a water cooling jacket in the conducting shell. 7 figs., 1 tab.

10548 (LA—11139-C, pp 111-121) **Design of the ZTH vacuum liner.** Gnesotto, F. (EURATOM-ENEA-CNR Association, Padova, Italy). Nov 1987. NTIS, PC A27. Order Number DE88001915/JAW. (CONF-8707105—).

From International workshop on engineering design of next step reversed field pinch devices; Los Alamos, NM, USA (13 Jul 1987).

The reasons that led to the choice of covering the RFX vacuum vessel with a full graphite armor are firstly outlined and a comparison is made with other possible first wall configurations. The main design features of the graphite tiles and the material properties are described, with particular reference to the calculation of mechanical stresses due to clamping forces and electrodynamic actions, and to the thermal transient analysis. Finally, the effect of a 40 m^2 plasma-facing graphite surface on particle recycling and impurity production is discussed and PWI control criteria are proposed. 8 refs., 6 figs., 3 tabs.

10549 (LA—11139-C, pp 123-131) **RFX vacuum vessel and shell.** Gnesotto, F. (EURATOM-ENEA-CNR Association, Padova, Italy). Nov 1987. NTIS, PC A27. Order Number DE88001915/JAW. (CONF-8707105—).

From International workshop on engineering design of next step reversed field pinch devices; Los Alamos, NM, USA (13 Jul 1987).

The design of the RFX toroidal vacuum vessel and shell is described. The main characteristics of both components are reported, as well as the most significant technological aspects of their construction. The main results of mechanical and electromagnetic calculations are then discussed in terms of reliability of the load assembly and influence on plasma behavior. Finally, the torus temperature control system is described. 7 refs., 3 figs., 2 tabs.

10550 (LA—11139-C, pp 133-143) **ZTH basic machine structure.** Giger, A. (Los Alamos National Lab., NM). Nov 1987. NTIS, PC A27. Order Number DE88001915/JAW. (CONF-8707105—).

From International workshop on engineering design of next step reversed field pinch devices; Los Alamos, NM, USA (13 Jul 1987).

This paper discusses some items of the mechanical supports for the ZTH reverse field pinch machine. Since the magnetic force loads are much greater than the loads due to gravity, they take precedence in the design considerations. 6 figs., 1 tab. (JDH)

10551 (LA—11139-C, pp 145-156) **Structural analysis of vacuum chamber.** Suzuki, N.; Uesaka, M.; Ogawa, K. (Ishikawajima-Harima Heavy Industries Co., Ltd., Tokyo, Japan). Nov 1987. NTIS, PC A27. Order Number DE88001915/JAW. (CONF-8707105—).

From International workshop on engineering design of next step reversed field pinch devices; Los Alamos, NM, USA (13 Jul 1987).

Structural analysis of vacuum chamber of an RFP, which consists of thin bellows and straight cylinder is presented. Electromagnetic force due to eddy currents in a vacuum chamber and a shell is considered. The eddy current induced in the shell rises with characteristic time of plasma current disruption. The eddy current induced in the vacuum chamber reaches its peak value in much shorter time than the shell current. A stress analysis of the chamber is carried out. It is confirmed that a bellows section tends to bulge outward of torus. 8 figs.

10552 (LA—11139-C, pp 157-161) **Computer control and data acquisition.** Wilkins, R.W.; Mann, L.W. (Los Alamos National Lab., NM). Nov 1987. NTIS, PC A27. Order Number DE88001915/JAW. (CONF-8707105—).

From International workshop on engineering design of next step reversed field pinch devices; Los Alamos, NM, USA (13 Jul 1987).

The computer control and data acquisition system for CPRF/ZTH is now being designed. The control system will be based on an industrial process control system using off-the-shelf components as much as possible. The data acquisition system will be CAMAC based and will be developed in-house making extensive use of existing systems from Los Alamos and other fusion laboratories. 1 fig., 1 tab.

10553 (LA—11139-C, pp 163-182) **ZTH magnetics design.** Gribble, R.F. (Los Alamos National Lab., NM). Nov 1987. NTIS, PC A27. Order Number DE88001915/JAW. (CONF-8707105—).

From International workshop on engineering design of next step reversed field pinch devices; Los Alamos, NM, USA (13 Jul 1987).

A method devised to optimize ZTH OH and EF coil locations has provided a design that meets specifications including minimizing costs. Several types of circuit simulations show that the design will with high probability be capable of plasma boundary flux surface control with EF supplies rated at a power level only slightly greater than that required to supply resistive losses for the maximum current rating of the EF coils. EF coil current rating is 25% greater than the currents required for equilibrium at 4 MA and Shafranov Λ of -0.1. 2 refs., 7 figs., 1 tab.

10554 (LA—11139-C, pp 183-200) **Plasma equilibrium for ZTH.** Baker, D.A.; Gribble, R.F.; Hyot, M.S.; Ling, K.M. (Los Alamos National Lab., NM). Nov 1987. NTIS, PC A27. Order Number DE88001915/JAW. (CONF-8707105—).

From International workshop on engineering design of next step reversed field pinch devices; Los Alamos, NM, USA (13 Jul 1987).

We present here the rationale and considerations concerning the equilibrium and feedback used in the design of the ZTH experiment. In this paper, the ohmic heating (OH) and equilibrium (EF) coil locations are prescribed. In particular the arrangement has been chosen so that the OH coils produce a negligible field in the plasma region and, with the plasma present, the induced currents in the EF coils produce the correct vertical field for a nominal equilibrium. 14 refs., 7 figs.

10555 (LA—11139-C, pp 201-206) **CPRF/ZTH poloidal and toroidal field coil sets.** Rogers, J.D.; Gribble, R.; Linton, T. (Los Alamos National Lab., NM). Nov 1987. NTIS, PC A27. Order Number DE88001915/JAW. (CONF-8707105—).

From International workshop on engineering design of next step reversed field pinch devices; Los Alamos, NM, USA (13 Jul 1987).

The ZTH is a reverse field pinch fusion machine being designed for construction and operation at the Los Alamos National Laboratory (LANL). The plasma magnetic confinement and reversed field is accomplished by poloidal field and toroidal field coils. These coils are to be made of copper conductor with water cooling and are to be vacuum/pressure epoxy impregnated with insulating materials - fiberglass, G10 epoxy fiberglass laminate, Kapton, and possibly Mylar. The poloidal field coils are divided into two subsets according to their function and are called ohmic heating (OH) and equilibrium field (EF) coils. They are symmetrical in geometrical arrangement across a horizontal midplane, thus, the coils are mirror image pairs. The coils are to be made of OFHC CDA 104 copper. Specifications of the coils are presented here. 1 fig., 7 tabs.

10556 (LA—11139-C, pp 207-213) **Poloidal divertor design for next step STE-RFP device.** Oshiyama, H. (Kyoto Institute of Technology, Japan). Nov 1987. NTIS, PC A27. Order Number DE88001915/JAW. (CONF-8707105—).

From International workshop on engineering design of next step reversed field pinch devices; Los Alamos, NM, USA (13 Jul 1987).

This paper presents a brief summary of a poloidal field divertor design for the next step STE-RFP device. The magnetic field lines which form the diverted magnetic flux are calculated by solving the equation of field lines in terms of a usual Runge-Kutta fourth order method. The factors determining plasma flow into the divertor are discussed and the exhaust and screening efficiencies characterizing the divertor scrape-off layer are also considered. 5 refs., 4 figs.

10557 (LA—11139-C, pp 215-238) **Magnetics and winding design in RFX.** Stella, A. (EURATOM-ENEA-CNR Association, Padova, Italy). Nov 1987. NTIS, PC A27. Order Number DE88001915/JAW. (CONF-8707105—).

From International workshop on engineering design of next step reversed field pinch devices; Los Alamos, NM, USA (13 Jul 1987).

The present contribution deals with both Poloidal Field (PF) and Toroidal Field (TF) Systems in RFX. After a short review of the basic concepts representing the theoretical background of the PF System, a number of considerations are made on the specified physical constraints which narrow the choice of the engineering parameters. The PF coils' design is then presented pointing out the most peculiar features. A number of technological and manufacturing aspects of the magnetizing winding are also given. The TF Coils are also designed to tight physical specifications but their most tricky engineering problems come mainly from constraints specified in order to provide easy and quick accessibility and maintenance. The paper describes the TF coil design, the field operation, and performance. The paper anticipates also a number of technological problems which will have to be taken into account during detailed design and manufacture. 8 refs., 14 figs., 6 tabs.

10558 (LA—11139-C, pp 239-244) **ZTH generator.** Rosev, B.J. (Los Alamos National Lab., NM). Nov 1987. NTIS, PC A27. Order Number DE88001915/JAW. (CONF-8707105—).

From International workshop on engineering design of next step reversed field pinch devices; Los Alamos, NM, USA (13 Jul 1987).

The 4 MA ZTH fusion experiment requires about 800 MW of power and 600 MJ. That amount of power and energy cannot be taken from the local utility system. Inertial energy storage by a pulsed generator is necessary. It is more cost effective to use a surplus generator instead of a specially designed pulsed generator. After discussions with several major turbogenerator manufacturers the recommendation was to use an 1800 RPM machine instead of a 3600 RPM. The 1800 RPM generators built primarily for nuclear applications experience lower dynamic stresses and fit better for our pulse mode operation. 2 figs.

10559 (LA—11139-C, pp 245-252) **Lightning protection scheme for the CPRF/ZTH system complex.** Konkel, H. (Los Alamos National Lab., NM). Nov 1987. NTIS, PC A27. Order Number DE88001915/JAW. (CONF-8707105—).

From International workshop on engineering design of next step reversed field pinch devices; Los Alamos, NM, USA (13 Jul 1987).

This paper describes some of the background in the design and the lightning protection and grounding scheme recommended for the CPRF/ZTH system at the Los Alamos Laboratory. Standard power industry practices were applied to minimize the effect on both the system and personnel of a high magnitude, direct lightning discharge in the CPRF/ZTH area. The recommended scheme is in compliance with existing local and national electric and safety codes. 7 refs., 3 figs.

10560 (LA—11139-C, pp 253-256) **ZTH toroidal field energy system.** Melton, J.G. (Los Alamos National Lab., NM). Nov 1987. NTIS, PC A27. Order Number DE88001915/JAW. (CONF-8707105—).

From International workshop on engineering design of next step reversed field pinch devices; Los Alamos, NM, USA (13 Jul 1987).

The ZTH toroidal field energy system is in the preliminary design phase. The bias toroidal magnetic field for the RFP experiment will be established by discharging a capacitor bank into the toroidal field coils. The capacitor bank will be allowed to ring during plasma current build-up to aid the reversal of toroidal magnetic field at the wall. During plasma current flat-top phase, the current in the TF coils will be sustained by thyristor converter power supplies. In addition to the usual features of RFP TF circuits described above, the ZTH TF circuit will have some unusual features. Because we want to be able to reverse the toroidal magnetic field much faster than the plasma current risetime (early reversal), the TF circuit must be capable of a wide and continuous range of reversal times, 0.5 ms to 50 ms. This requires a high degree of modularity of the TF coils and the capacitor banks. The converter power supply system must be capable of controlling the current in the TF coils to within 5% during the flat-top and ramp phases. 4 figs.

10561 (LA—11139-C, pp 257-261) **RFX toroidal field power supply.** Gray, J.W. (UKAEA Culham Lab., Abingdom). Nov 1987. NTIS, PC A27. Order Number DE88001915/JAW. (CONF-8707105—).

From International workshop on engineering design of next step reversed field pinch devices; Los Alamos, NM, USA (13 Jul 1987).

The toroidal field is provided by a 48 coil 8 turn winding evenly distributed around the major circumference as close as possible to the outer surface of the conducting shell which coaxially encloses the plasma vacuum vessel (liner). The poloidal field system consists of a set of magnetizing coils distributed around the torus to produce 15Wb flux swing with very low stray field in the plasma

region, and also a set of 16 field shaping coils located just outside the toroidal field coils. These coils are connected in pairs and are fed by eight independent power supply modules to provide accurate field control at the shell surface. The power supply system described here is essentially based upon a modular system of converters and capacitor banks. 2 refs., 7 figs.

10562 (LA—11139-C, pp 263-266) **A preliminary study of a power supply system for REPUTE-II.** Ishigaki, Y.; Itou, Y. (Hitachi Ltd., Ibaraki, Japan). Nov 1987. NTIS, PC A27. Order Number DE88001915/JAW. (CONF-8707105—).

From International workshop on engineering design of next step reversed field pinch devices; Los Alamos, NM, USA (13 Jul 1987).

This paper contains some calculated parameters for the REPUTE-II power supply. 4 figs., 2 tabs. (JDH)

10563 (LA—11139-C, pp 267-273) **Power supply system for TPE-RX1 and TPE-RX.** Ogawa, K.; Shimada, T.; Hirano, Y.; Yagi, Y.; Oyabu, I.; Yamaguchi, S.; Yamane, M. Nov 1987. NTIS, PC A27. Order Number DE88001915/JAW. (CONF-8707105—).

From International workshop on engineering design of next step reversed field pinch devices; Los Alamos, NM, USA (13 Jul 1987).

The TPE-R x 1 is a medium-size RFP. The technology of the power supply system holds the key to the construction and performance of the experiments. In this paper the machine and plasma parameters are summarized, then the preliminary design of the power supply system is presented. 4 figs., 1 tab.

10564 (LA—11139-C, pp 275-285) **AC power station: Layout and interaction with the grid.** Fellin, L. (Universita di Padova, Italy). Nov 1987. NTIS, PC A27. Order Number DE88001915/JAW. (CONF-8707105—).

From International workshop on engineering design of next step reversed field pinch devices; Los Alamos, NM, USA (13 Jul 1987).

The layout of the RFX's AC network, which is fed by the Italian 400 kV grid, is presented. The design of the step-down transformers, which are the most critical components, is briefly discussed. The criteria followed in the analysis of the interaction of the power system with the grid are discussed and the employed calculation tools, with their main results, are presented. 6 refs., 7 figs.

10565 (LA—11139-C, pp 287-292) **Preliminary design of the poloidal field energy system for ZTH.** Boenig, H.J. (Los Alamos National Lab., NM). Nov 1987. NTIS, PC A27. Order Number DE88001915/JAW. (CONF-8707105—).

From International workshop on engineering design of next step reversed field pinch devices; Los Alamos, NM, USA (13 Jul 1987).

The design of the ZTH poloidal energy system is in the preliminary stage. For a plasma current of 2 MA four ohmic heating power supplies with a rating of 3840 V at 12.5 kA are required. For a 4 MA plasma current the supplies must be expanded to provide 3840 V at 50 kA. The present design makes use of the four charging supplies also as ramping and flat-top supplies. The total switch requirement in the poloidal energy system has been specified. A prototype 50 kA/50 kV dc current interrupter has been developed and tested in the laboratory in over 100 shots and in 12 shots at 55 kV/55 kA. The sixteen equilibrium supplies require a total power installation of 60 MW for 4 MA operation. The current transfer resistor design calls for a linear, water cooled resistor. Development of a non-linear MOV based transfer resistor is being undertaken. 4 figs.

10566 (LA—11139-C, pp 293-302) **RFX poloidal field power supply.** Maschio, A. (EURATOM-ENEA-CNR Association, Padova, Italy). Nov 1987. NTIS, PC A27. Order Number DE88001915/JAW. (CONF-8707105—).

From International workshop on engineering design of next step reversed field pinch devices; Los Alamos, NM, USA (13 Jul 1987).

The scheme and the operating principles of the poloidal field circuit of RFX are presented. The final structure of the different components of the power supply system is presented and the major problems met during the design phase are discussed. Finally the calculation tools set up for the study of the overall system are briefly described, while large reference is made to the already existing literature on these subjects. 10 refs., 4 figs., 1 tab.

10567 (LA—11139-C, pp 309-315) **Operation of an RFP [Reversed Field Pinch] with a modular shell.** Schmid, P.; Robertson, S. (Univ. of Colorado, Boulder). Nov 1987. NTIS, PC A27. Order Number DE88001915/JAW. (CONF-8707105—).

From International workshop on engineering design of next step reversed field pinch devices; Los Alamos, NM, USA (13 Jul 1987).

A shell having many gaps will allow modular construction of an ignition-scale RFP. Modular shells with cuts every 20° in toroidal angle are being tested on the Reversatron. A very thin shell of 0.3 mm aluminum with a 40 μsec penetration time gives a higher plasma resistance and shorter discharge duration than is obtained with a thick conventional shell. Performance is better than with no shell, however. The experiment is to be repeated with a 1.25 mm modular shell. 6 refs., 5 figs.

10568 (LA—11139-C, pp 343-348) **A tapered poloidal gap for the reduction of field errors.** Moses, R.W. (Los Alamos National Lab., NM). Nov 1987. NTIS, PC A27. Order Number DE88001915/JAW. (CONF-8707105—).

From International workshop on engineering design of next step reversed field pinch devices; Los Alamos, NM, USA (13 Jul 1987).

The conventional Reversed Field Pinch is surrounded by a toroidal conducting shell that provides wall stabilization for the plasma. Usually, this shell is made of aluminum or copper, and it must have an insulated poloidal gap to permit penetrations of toroidal loop voltage to the plasma. Many magnetic field perturbations will induce toroidal shell currents with poloidal Fourier components having mode numbers $m \geq 1$. A butt-joint poloidal gap will mode convert all of these image currents into potentially damaging magnetic-field errors with large spectra of toroidal-mode numbers. Overlapping tapered gaps have been proposed and partially tested for reducing these field errors. The mathematical basis for minimizing the $m = 1$, $n = 0$ field errors for all frequencies using tapered gaps, is presented in this paper. 3 refs., 2 figs.

10569 (LA—11139-C, pp 375-382) **CPRF/ZTH shell poloidal gap design and fabrication.** Yavornik, E.J.; Moses, R.W.; Dransfield, G.D. (Los Alamos National Lab., NM). Nov 1987. NTIS, PC A27. Order Number DE88001915/JAW. (CONF-8707105—).

From International workshop on engineering design of next step reversed field pinch devices; Los Alamos, NM, USA (13 Jul 1987).

Design is in progress of a new generation RFP machine to be assembled at Los Alamos National Laboratory. The confinement Physics contains the Shell Poloidal Gap. This paper presents the gap design. 6 figs.

10570 (LA—11139-C, pp 383-391) **CPRF/ZTH toroidal conducting shell finite element stress analysis.** Baker, C.L.; Ballard, E.O.; Dransfield, G.D. (Los Alamos National Lab., NM). Nov 1987. NTIS, PC A27. Order Number DE88001915/JAW. (CONF-8707105—).

From International workshop on engineering design of next step reversed field pinch devices; Los Alamos, NM, USA (13 Jul 1987).

This paper describes use of the finite element method to perform stress analysis on the ZTH reverse field pinch device's conducting shell. 7 figs. (JDH)

10571 (LA—11139-C, pp 393-404) **Vacuum/gas handling systems for ZTH.** Downing, J.N. (Los Alamos National Lab., NM). Nov 1987. NTIS, PC A27. Order Number DE88001915/JAW. (CONF-8707105—).

From International workshop on engineering design of next step reversed field pinch devices; Los Alamos, NM, USA (13 Jul 1987).

The proposed ZTH vacuum system consists of three (potentially four or more) high-vacuum-pumping-stations (HVPSs), a gas handling system, a roughing system, and a vacuum control system. Each high vacuum line consists of a turbomolecular pump (TMP) pumping stack connected to the torus through a right-angle valve, a duct, and a 2 kV insulating break/bellows combination. The HVPSs are designed to be bakeable to at least 150 C. The gate seals on the high-vacuum valves are vision O-rings. Throughout the vacuum liner and high-vacuum pumping system, metal sealed joints are used where possible. Any O-ring seals, other than the gate seals, are a double-pumped configuration where a roughing vacuum is maintained between the O-rings. The insulating break eliminates ground loop currents, and the bellows mechanically decouples the pumping from the vacuum liner. This bellows section will accommodate the dimensional changes caused by heating the liner and/or the high-vacuum system.

10572 (LA—11139-C, pp 405-415) **Armor/heat flux design for ZTH.** Downing, J.N. (Los Alamos National Lab., NM). Nov 1987. NTIS, PC A27. Order Number DE88001915/JAW. (CONF-8707105—).

From International workshop on engineering design of next step reversed field pinch devices; Los Alamos, NM, USA (13 Jul 1987).

A simplified model for the scrape-off-layer (SOL) in reversed field pinches (RFP's) has been developed and applied to CPRF/ZTH. The objectives of this exercise are: (a) to determine the sensitivity of the poloidal heat flux distribution as a function of plasma position; (b) to estimate the heat flux enhancement resulting from the removal of armor or wall material; and (c) to estimate the impact of magnetic field errors on the heat flux distribution. The heat flux distribution in the SOL was assumed to be described by an exponential with a characteristic scrape-off length (lambda/sub perpendicular/ = 0.2 to 2.0 em). When a section of the armor is removed, the field lines can produce peaking factors PF's) in the range of 10 to 1000. The front-surface temperatures have been estimated for flat tiles with the nominal and maximum time-dependent heat fluxes anticipated for ZTH. The maximum front surface temperature is estimated to be 1500 K at the design point. 1 ref., 8 figs., 3 tabs. (JDH)

10573 (LA—11139-C, pp 417-425) **On procedure of assembly and disassembly of RFP [Reversed Field Pinch] apparatus.** Suzuki, N.; Odagiri, K.; Miyauchi, Y.; Oomura, H.; Ukikusa, H.; Ogawa, K. (Ishikawajima-Harima Heavy Industries Co., Ltd., Tokyo, Japan). Nov 1987. NTIS, PC A27. Order Number DE88001915/JAW. (CONF-8707105—).

From International workshop on engineering design of next step reversed field pinch devices; Los Alamos, NM, USA (13 Jul 1987).

An RFP experimental apparatus which has simple structure is proposed. The simple structure makes a term for assembly and disassembly shorter. An accessibility to the machine also becomes better. 12 figs., 1 tab.

10574 (LA—11139-C, pp 427-431) **CPRF/ZTH system thermal analysis.** Gamble, M.T. (Los Alamos National Lab., NM). Nov 1987. NTIS, PC A27. Order Number DE88001915/JAW. (CONF-8707105—).

From International workshop on engineering design of next step reversed field pinch devices; Los Alamos, NM, USA (13 Jul 1987).

The first-order heat transfer analysis of the ZTH system bake-out condition is complete. Useful design results were obtained from the simple one dimensional model. Currently, a finite element model of the front-end is under development. The baseline configuration will provide confirmation of the model's accuracy. However, this more sophisticated approach will facilitate indepth parameter investigations for steady state operations and provide a powerful tool for transient analysis as well. 3 figs.

10575 (LBL—24105) **A dc sheet plasma for extraction of H^- and D^-.** Lietzke, A.F.; Guethlein, G. (Lawrence Berkeley Lab., CA (USA)). Oct 1987. Contract AC03-76SF00098. 5p. (CONF-871007—63). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88002765/JAW.

From 12. symposium on fusion engineering; Monterey, CA, USA (12 Oct 1987).

We are testing operation and H^- yield of a sheet plasma source having a narrow primary electron channel (11 cm high, 30 cm long, and <1 cm wide). The design goal was J/sub H^-/ = 30 mA/cm² at V/sub arc/ = 100V, I/sub arc/ = 200A, B < 200g, and p/sub g/ = 5mT. Conditions outside the sheet are favorable for H^- production; at p/sub g/ = 10mT (cold fill - 8 sccm), V/sub arc/ = 75V, I/sub arc/ = 125A, and B = 200 G, 1 cm from the sheet edge, J^+ = 380 mA/cm², T/sub e/ = 1.4 eV, and n/sub e/ = 5 . 10^{12}/cm³, determined from Langmuir probe measurements. The movable negative ion extractor has a circular source aperture of area 1 cm². J/sub H^-/ is measured calorimetrically as well as electrically. Agreement of these two signals confirms the effectiveness of the carbon electron dump. Initial extraction at the above conditions produced J/sub H^-/ = 7 mA/cm² at 2 cm from the sheet edge. This current density is far below the design goals. We conclude that the sheet geometry is not primarily responsible for the high yield of J/sub H^-/. 2 refs., 5 figs., 1 tab.

10576 (ORNL/FEDC—86/9) **Systems code assessment of innovations, major design drivers, and minimum sizes of INTOR [International Tokamak Reactor] and ETR-like designs.** Galambos, J.D.; Peng, Y.K.M.; Strickler, D.J.; Reid, R.L. (Oak Ridge National Lab., TN (USA)). Oct 1987. Contract AC05-84OR21400. 52p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE88003647/JAW.

System studies of next-generation superconducting tokamaks are presented here. These studies include examining design changes suggested for the International Tokamak Reactor (INTOR) as a means of reducing the size and simplifying the device and assessing the impact of a series of more aggressive design assumptions suggested in recent Engineering Test Reactor (ETR) studies. Also, a set of candidate design points offering small machines (major radius = 4 m) with a relatively conservative mix of design assumptions is proposed. Some of the design assumptions found to have a major effect on the minimum size are TF coil current density, noninductive current drive, plasma elongation and edge q, plasma temperature for current drive, maximum allowable plasma beta, the minimum required wall load, and assumptions on fixed radial dimensions such as shield thickness, gaps, and plasma scrapeoff. Some design assumptions with less impact on the device size are the OH coil current density, PF configuration (limiter/divertor), and plasma current level. 22 refs., 5 figs., 6 tabs.

10577 (ORNL/FEDC—87/1) **Cooldown of the Compact Ignition Tokamak.** Keeton, D.C. (Oak Ridge National Lab., TN (USA)). Aug 1987. Contract AC05-84OR21400. 88p. NTIS, PC A05/MF A01; 1; GPO Dep. Order Number DE88003668/JAW.

Cooldown of the Compact Ignition Tokamak (CIT) with the baseline liquid nitrogen cooling system was analyzed. On the basis of this analysis and present knowledge of the two-phase heat transfer, the current baseline CIT can be cooled down in about 1.5 h. An extensive heat transfer test program is recommended to reduce uncertainty in the heat transfer performance and to explore methods for minimizing the cooldown time. An alternate CIT cooldown system is described which uses a pressurized gaseous helium coolant in a closed-loop system. It is shown analytically that this system will cool down the CIT well within 1 h. Confidence in this analysis is sufficiently high that a heat transfer test program would not be necessary. The added cost of this alternate system is estimated to be about $5.3 million. This helium cooling system represents a reasonable backup approach to liquid nitrogen cooling of the CIT. 3 refs., 12 figs., 3 tabs.

10578 **(ORNL/FEDC—87/2) Poloidal magnetics of a divertor compact ignition tokamak.** Strickler, D.J.; Peng, Y.K.M.; Jardin, S.C. (Oak Ridge National Lab., TN (USA)). Oct 1987. Contract AC05-84OR21400. 24p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88003648/JAW.

A technique is presented for calculating bounds on the poloidal field (PF) coil currents required to constrain critical plasma shape parameters when plasma pressure and current density profiles are changed. Such considerations are important in the conceptual design of the PF coils for the Compact Ignition Tokamak (CIT) and their electrical power systems in view of the uncertainty in plasma profiles and operating scenarios. Four relatively independent coil groups are sufficient to find a coil current distribution and equilibrium satisfying a prescribed plasma major radius, minor radius, and divertor strike point coordinates. The variation in the coil current distribution with plasma profiles tends to be large for external PF systems and provides a measure by which coil configurations may be compared. 6 refs., 7 figs., 4 tabs.

10579 **(ORNL/TM—10297) Electron-impact ionization data for the Fe isonuclear sequence.** Pindzola, M.S.; Griffin, D.C.; Bottcher, C.; Younger, S.M.; Hunter, H.T. (Oak Ridge National Lab., TN (USA)). Nov 1987. Contract AC05-84OR21400. 63p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE88003660/JAW.

Collision processes involving highly ionized iron impurities play an important role in magnetically confined fusion plasmas. Available experimental and theoretical cross-section data for electron-impact ionization of ions in the Fe isonuclear sequence in charge states ranging from 1 to 26 are reviewed, and recommended data for each charge state are presented graphically. Contributions to the ionization cross sections due to inner-shell excitation-autoionization have been considered in detail for each ionization stage and make substantial contributions for the intermediate charge states. The role of metastable levels in ionization is also addressed. Maxwellian collisional rate coefficients are calculated from these recommended cross-section data and presented in tabular, graphical, and parametrized form. Comments are made on current research activities leading to future data for Fe ions. 23 refs., 29 figs., 12 tabs.

10580 **(ORNL/TM—10391) Asymmetric double Langmuir probe: Small signal application.** Uckan, T. (Oak Ridge National Lab., TN (USA)). Nov 1987. Contract AC05-84OR21400. 18p. NTIS, PC A03/MF A01; GPO Dep. Order Number DE88003663/JAW.

We discuss the asymmetric double Langmuir probe (ADLP) and demonstrate the possibility of using it to measure plasma temperature T/sub e/ and density n when it is operated in the region of small signal response. The area of one of the ADLP collectors is considerably larger than the other. This probe can be operated at a relatively low applied voltage, eV/sub a/T/sub e/ $<$ 1, and still provides sufficient information to determine the plasma T/sub e/ and n. There is no need for a direct measurement of the ion saturation current, which can be on the order of a few amperes in large fusion devices. This reduces the requirements on the probe power supply. 6 refs., 6 figs.

10581 **(ORNL/TM—10556) Neutral and plasma shielding model for pellet ablation.** Houlberg, W.A.; Milora, S.L.; Attenberger, S.E. (Oak Ridge National Lab., TN (USA)). Oct 1987. Contract AC05-84OR21400. 40p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88003649/JAW.

The neutral gas shielding model for ablation of frozen hydrogenic pellets is extended to include the effects of an initial Maxwelliam distribution of incident electron energies; a cold plasma shield outside the neutral shield and extended along the magnetic field; energetic neutral beam ions and alpha particles; and self-limiting electron ablation in the collisionless plasma limit. Including the full electron distributiou increases ablation, but adding the cold ionized shield reduces ablation; the net effect is a modest reduction in pellet penetration compared with the monoenergetic electron neutral shielding model with no plasma shield. Unlike electrons, fast ions can enter the neutral shield directly without passing through the cold ionized shield because their gyro-orbits are typically larger than the diameter of the cold plasma tube. Fast alpha particles should not enhance the ablation rate unless their population exceeds that expected from local classical thermalization. Fast beam ions, however, may enhance ablation in the plasma periphery if their population is high enough. Self-limiting ablation in the collisionless limit leads to a temporary distortion of the original plasma electron Maxwellian distribution function through preferential depopulation of the higher-energy electrons. 23 refs., 9 figs.

10582 **(ORNL/TM—10560) Design considerations of modular pump limiters for large tokamaks.** Uckan, T.; Klepper, C.C.; Mioduszewski, P.K. (Oak Ridge National Lab., TN (USA)). Nov 1987. Contract AC05-84OR21400. 27p. (CONF-871007—32). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88003662/JAW.

From 12. symposium on fusion engineering; Monterey, CA, USA (12 Oct 1987).

Long-pulse (>10-s) and high-power (>10-MW) operation of large tokamaks requires multiple limiter modules for particle and heat removal, and the power load must be distributed among a number of modules. Because each added module changes the performance of all the others, a set of design criteria must be defined for the overall limiter system. The relationship between individual modules must also be considered from the standpoint of flux coverage and shadowing effects. This paper addresses these issues and provides design guidelines. Parameters of the individual modules are then determined from the system requirements for particle and power removal. Long-pulse operation of large tokamaks requires that the limiter modules be equipped with active cooling. At the leading edge of a module, the cooling channel determines the thickness of the limiter blade (or head). A model has been developed for estimating the system exhaust efficiency in terms of the parameters of the leading edge (i.e., its thickness and the design heat flux) in terms of given device parameters and the power load that must be removed. The impact on module design of state-of-the-art engineering technology for high heat removal is discussed. The choice of locations for the modules is also investigated, and the effects of shadowing between modules on particle and power removal are examined. The results are applied to the Tore Supra tokamak. Conceptual design parameters of the modular pump limiter system are given. 10 refs., 5 figs.

10583 **(PPPL—2466) Gas utilization in TFTR [Tokamak Fusion Test Reactor] neutral beam injectors.** Kamperschroer, J.H.; Gammel, G.M.; Kugel, H.W.; Grisham, L.R.; Stevenson, T.N.; von Halle, A.; Williams, M.D. (Princeton Univ., NJ (USA). Plasma Physics Lab.; JET Joint Undertaking, Abingdon (UK)). Aug 1987. Contract AC02-76CH03073. 28p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88003469/JAW.

Measurements of gas utilization in a test TFTR neutral beam injector have been performed to study the feasibility of running tritium neutral beams with existing ion sources. Gas consumption is limited by the restriction of 50,000 curies of T_2 allowed on site. It was found that the gas efficiency of the present long-pulse ion sources is higher than it was with previous short-pulse sources. Gas efficiencies were studied over the range of 35 to 55%. At the high end of this range the neutral fraction of the beam fell below that predicted by room temperature molecular gas flow. This is consistent with observations made on the JET injectors, where it has been attributed to beam heating of the neutralizer gas and a concomitant increase in conductance. It was found that a working gas isotope exchange from H_2 to D_2 could be accomplished on the first beam shot after changing the gas supply, without any intermediate preconditioning. The mechanism believed responsible for this phenomenon is heating of the plasma generator walls by the arc and a resulting thermal desorption of all previously adsorbed and implanted gas. Finally, it was observed that an ion source conditioned to 120 kV operation could produce a beam pulse after a waiting period of fourteen hours by preceding the beam extraction with several hi-pot/filament warm-up pulses, without any gas consumption. 18 refs., 7 figs., 2 tabs.

10584 **(RISO-M—2662) Comparisons among various possible ways to accelerate high-speed pellets under constant base pressure.** Xue, Ming-Lun. (Risoe National Lab., Roskilde (Denmark)). Sep 1987. 26p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88751480/JAW.

Various possibilities to accelerate a frozen hydrogenic pellet by means of a constant base pressure behind the pellet are examined.

10585 **(UCRL—97461) Microwave system for the microwave tokamak experiment (MTX).** Felker, B.; Ferguson, W.; Heefner, J.; Krause, K.; Makowski, M.; Yamamoto, R. (Lawrence Livermore National Lab., CA (USA)). Oct 1987. Contract W-7405-ENG-48. 5p. (CONF-871007—66). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88002391/JAW.

From 12. symposium on fusion engineering; Monterey, CA, USA (12 Oct 1987).

The microwave system for the Microwave Tokamak Experiment (MTX) will include part of the Lower Hybrid Heating (LHH) system used at Massachusetts Institute of Technology (MIT) on the Alcator machine and the new Free Electron Laser (FEL) microwave system being developed at LLNL. The LHH system for MTX will be two carts of four klystrons, each with a nominal total power of 2.1 MW at 4.6 GHz. The FEL system will deliver 2-MW average power at 250 GHz. 50 ns pulses every 200 μs of 8 gigawatt peak power will deliver the 2-MW average power. This paper will present both the LHH system from MIT and the FEL transmission system, which includes the master oscillator, launch into the FEL, mirrors, and transport system into the MTX. The microwave transmission system, microwave beam diagnostics, present design status, and other related issues will be presented. The MTX joins two devices, ETA-II and Alcator-C, through a beamline. 4 figs., 4 tabs.

10586 **Rotating liquid blanket for a toroidal fusion reactor.** Moir, R.W. (Lawrence Livermore National Lab., CA, USA). *Fusion Energy and Design;* **5**: No. 3, 269-272(Oct 1987). Contract W-7405-ENG-48.

A novel blanket concept is presented for toroidal geometry in which many of the limitations imposed by a first wall are avoided by not having a first wall in the usual sense. The blanket consists of a rapidly rotating, low-vapor-pressure liquid that has a sharp boundary with the vacuum region. Nozzles inject ja continuous layer of cool liquid on the inner surface. The noncentricity of the plasma is maintained so that the plasma scrape-off region intersects the rotating liqid in a localized region. This noncentricity allows sufficient space so that the scrape-off plasma layer will not bombard the nozzles, whch penetrate through the rotating liquid. This liquid "first wall" is bombarded by the plasma, resulting in heat deposiion, sputtering, and evaporation during the short time before the exposed liquid is covered by fresh, cool liquid from the nozzles. The advantages of this reactor concept appear to be very high wall loadings (speculated to be over 10 MW/m/sup 2/) and long component lifetime, both crucial economic factors. The nozzles are designed for easy replacement. The reactor's disatvantage is its enormous potential for plasma contamination by impurities.

10587 **Liquid metal chemical reaction safety in fusion facilities.** Piet, S.J.; Corradini, M.L.; Jeppson, D.W.; Muhlestein, L.D.; Kazimi, M.S. (Idaho National Engineering Lab., Idaho Falls, USA; Hanford Engineering Development Lab., Richland, WA, USA; Massachusetts Inst. of Tech., Cambridge, USA). *Fusion Energy and Design;* **5**: No. 3, 273-298(Oct 1987). Contract AC07-76ID01570.

Safety implications of chemical reaction associated with postulated accident conditions with liquid metals (LM's) are discussed, along with possible prevention and mitigation techniques. The safety issues for handling lithium or 17Li83Pb are complex. However, enough is known to conclude that either LM can be safety used in deuterium-tritium fusion facilities if certain solutions can be implemented in designs at acceptable costs. The overall safety objective is to prevent significant accidental chemical reactions when possible and to mitigate the consequence of reactions that do occur. Passive design features should be used to limit maximum accident consequences, either facility damage from energy release or public health effects from radioactivity mobilization. Also the total risk (consequence and frequency) of accidental chemical reactions should be limited. Available data on safety-related LM chemical reactions are reviewed, and the implications of reaction severity are indicated. Design and suggestions and recommendations are offered to help meet safety objectives in LM fusion facilities. These suggestions ate influenced by a) the facility fluence, b) the LM inventory, c) the desired level of inherent/passive safety, and d) the cost/benefit of design suggestions. Assuming a commercial-scale facility with large LM inventory with a goal of high levels of passive safety, recommendations for lithium designs include using nitrogen (rather than air) as the building atmosphere and a high reliability barrier covering concrete. Suggestions for either lithium or 17Li83Pb include eliminating water cooling within the building.

10588 **Overview of Tiber-II - evolution toward an engineering test reactor.** Henning, C.D.; Logan, B.G. (Lawrence Livermore National Lab., CA). *Journal of Fusion Energy;* **6**: No. 3, 241-256(Sep 1987). Contract W-7405-ENG-48.

TIBER II is designed to be a minimum size and cost candidate for an international Engineering Test Reactor. High-current density Nb_3Sn superconducting magnets with radiation-tolerant polymide insulation is combined with a minimum thickness tungsten inbored shield and a common, external vacuum boundary to minimize the inner radial build of the tokamak core. This results in a major radius of 3 m, compared to 5 m for previous ETR designs such as INTOR, with correspondingly lower costs expected. Cyclic stress fatigue limits the number of pulses so that steady-state current drive, based on a combination of neutral beams, lower hybrid and ECH, is designed to achieve reactor-relevant nuclear testing conditions (Fluence ≧ 3 MW yr/m^2, anti Gamma/sub wall/ > 1 MW/m^2 in steady state).

10589 **Twisted coil geometry in plasma confinement devices.** Walstrom, P.L. (Univ. of Wisconsin, Madison). *Journal of Fusion Energy;* **6**: No. 3, 265-273(Sep 1987).

Twisted coils, i.e., coils for which windings do not lie in a plane, are used widely in plasma confinement devices, especially those in the general class of stellerator-type devices. In the design of these devices ad hoc expressions for the positions of turns and the outer envelope of the windings are usually assumed. However, these expressions do not correctly represent the true shape taken by windings as successive turns and layers of turns are applied to a curved surface. In the present work, the techniques of differential geometry are used to determine the actual location of turns as they are wound on arbitrary surfaces. In the process, a set of natural winding coordinates is derived; the Biot Savart law for calculation of magnetic fields is expressed in terms of these natural coordinates. Next, the advantages of using a class of surfaces, called developables, for winding surfaces are discussed. A particular developable, called the rectifying developable, offers the additional advantages that the turns on it are geodesics and that wide flat conductors can be wound on it to minimize bending strains. Finally, the problem of windings with conductors of finite thickness is briefly discussed.

10590 **High-power glass laser phase control.** Kessler, T.; Skupsky, S.; Seka, W.; Feinberg, L.; Jacobs, S.; Marshall, K.; Sampat, N.; Smith, D.J.; Swales, S. (Univ. of Rochester, Lab. for Laser Energetics, Rochester, NY 14623). pp 52-54 of Proceedings of the conference on lasers and electro-optics. Piscataway, NJ; IEEE Service Center (1987). (CONF-870401—).

From OSA/IEEE conference on lasers and electro-optics (CLEO '87); Baltimore, MD, USA (27 Apr 1987).

Technical Paper TUI4.

The prospect of increasingly higher compressions, from direct drive laser fusion implosions, requires that the irradiance uniformity over the surface of the target be improved to the level of a few percent rms. Studies using 3-D beam superimposition and 2-D hydrodynamic simulation codes show that target plane nonuniformities, within each of the twenty-four beam intensity distributions of the Omega laser syste, are of crucial importance. The uniformity program at LLE has in the past concentrated on identifying the factors which affect the individual target plane profiles and investigating various wavefront control alternatives. In this work the authors discuss recent experimental and theoretical results involving

both direct phase and random phase optical techniques for use on the Omega laser system. The performance of phase plates, fabricated with novel thin film and glass polishing techniques, is discussed.

10591 **Polymer shell implosions.** Richardson, M.C.; Audebert, P.; Delettrez, J.; Epstein, R.; Jaanimagi, P.A.; Kremens, R.; Marshall, F.J.; Mc Kenty, P.W.; Mc Crory, R.L.; Skupsky, S. (Univ. of Rochester, Rochester, NY 14623). pp 52 of Proceedings of the conference on lasers and electro-optics. Piscataway, NJ; IEEE Service Center (1987). (CONF-870401—).

From OSA/IEEE conference on lasers and electro-optics (CLEO '87); Baltimore, MD, USA (27 Apr 1987).

Technical Paper TUI1.

Efficient direct-drive laser fusion places stringent requirements on the maintenance of implosion symmetry and the preservation of the target compression on a low thermal adiabat. The authors present the first detailed investigation of ablatively driven gas-filled polymer shell targets irradiated by the 24-beam 351-nm 2-kJ, 4-TW Omega laser system. The implosion of these targets was diagnosed with an extensive array of plasma, x-ray, and nuclear diagnostics. In addition, detailed characterization of the multibeam laser output provided an estimate of the illumination nonuniformities imposed on target. A detailed comparison of the symmetry and performance of these target implosions has been made with the predictions of the 1- and 2-D hydrodynamic codes LILAC and ORCHID, respectively.

10592 **Monte Carlo photon transport on shared memory and distributed memory parallel processors.** Martin, W.R.; Wan, T.C.; Abdel-Rahman, T.S.; Mudge, T.N.; Miura, K. (Univ. of Michigan, Ann Arbor, MI 48109). *International Journal of Supercomputer Application;* 1: No. 3, 57-74(1987).

Parallelized Monte Carlo algorithms for analyzing photon transport in an inertially confined fusion (ICF) plasma are considered. Algorithms were developed for shared memory (vector and scalar) and distributed memory (scalar) parallel processors. The shared memory algorithm was implemented on the IBM 3090/400, and timing results are presented for dedicated runs with two, three, and four processors. Two alternative distributed memory algorithms (replication and dispatching) were implemented on a hypercube parallel processor (1 through 64 nodes). The replication algorithm yields essentially full efficiency for all cube sizes; with the 64-node configuration, the absolute performance is nearly the same as with the CRAY X-MP. The dispatching algorithm also yields efficiencies above 80% in a large simulation for the 64-processor configuration.

10593 **Sensitivity analysis of MHD heat transfer in self-cooled liquid metal blankets.** Patel, D.K.; Hadid, A.H.; Abdou, M.A. New York, NY; American Society of Mechanical Engineers (1987). 6p. (CONF-861211—). American Society of Mechanical Engineers, 345 East 47 St., New York, NY 10017.

From American Society of Mechanical Engineers winter meeting; Anaheim, CA, USA (7 Dec 1986).

Technical Paper 86-WA/HT-1.

In laminar flow heat transfer, the convective capability of the flow depends on the velocity profile. In self-cooled liquid metal blankets of a fusion reactor, the presence of a magnetic field results in steep velocity gradients near the walls. In many locations in the blanket, such as where the flow turns around a bend or where the flow area of the channel and the direction of the magnetic field change, large changes in velocity gradients occur. These result in large changes in the first wall and blanket temperature distribution and substantially affect blanket performance. Numerical calculations were performed for the flow of an electrically conducting fluid in a plane channel in a magnetic field which is aligned with the direction of the mean flow. Velocity and temperature variations across the duct were evaluated for different velocity profiles at the inlet. It is shown that the presence of the magnetic field retards the development of the velocity profile. The solution of the energy equations for slug, parabolic and skewed velocity profiles shows that the highest heat transfer coefficients are obtained with the latter profile, which has the largest velocity gradient at the wall.

10594 **Passively safe tandem mirror fusion blanket afterheat thermal analysis.** Garner, J.K.; Carson, C.F.; Whitley, R.H.; Gordon, J.D. New York, NY; American Society of Mechanical Engineers (1987). 5p. (CONF-861211—). American Society of Mechanical Engineers, 345 East 47 St., New York, NY 10017.

From American Society of Mechanical Engineers winter meeting; Anaheim, CA, USA (7 Dec 1986).

Technical Paper 86-WA/HT-2.

This paper presents results of the thermal analysis of an inherently safe blanket design concept. The blanket is composed of V-15Cr-5Ti structure with lithium for tritium breeding, beryllium for neutron multiplication and SiC for neutron reflection and moderation. Cooling of the blanket is provided by flowing helium gas which is assumed to be unavailable for heat transfer during the accident. The blanket afterheat temperature response was calculated using the SINDA thermal analysis code. Afterheat source values were calculated separately and input as spacially and time varying quantities for each blanket zone. Results indicate that the first wall temperature will peak at 709°C in about 1 1/2 days and that the blanket will reach 760°C in one year. Any cooling, by convection to the reactor building atmosphere, for example, will reduce these temperatures. Our analysis indicates that this blanket can be left unattended and uncooled at shutdown.

10595 **Two-dimensional model for self-shield effects on the plasma-first wall interactions during a plasma disruption.** Chen, Y.K.; Varghese, P.L.; Howell, J.R. New York, NY; American Society of Mechanical Engineers (1987). 9p. (CONF-861211—). American Society of Mechanical Engineers, 345 East 47 St., New York, NY 10017.

From American Society of Mechanical Engineers winter meeting; Anaheim, CA, USA (7 Dec 1986).

Technical Paper 86-WA/HT-3.

During a plasma disruption the first wall will be damaged by deposition of plasma energy, and material will be eroded from the wall surface. If a significant vapor layer is produced by erosion of the wall, the kinetic energy of the plasma will be stopped in this vapor layer rather than in the first wall. A two-dimensional model for plasma-first wall interactions has been developed which includes the effect of vapor shielding, and it predicts sputtering, evaporation and melting rates of the first wall. The parameters used in calculation are for conditions typical of plasma disruptions in proposed tokamak devices. The results are bcalculated under the assumptions that the plasma and first wall are concentric or eccentric cylinders, and the plasma expands in the radial direction only during the disruption. The vapor shield greatly affects both the transient and total energy deposition, and significantly reduces the damage on the wall surface for high energy disruptions.

10596 **Thermal analysis of lead-lithium-cooled blankets for fusion reactors.** Schnurr, N.M.; Krakowski, R.A. New York, NY; American Society of Mechanical Engineers (1987). 10p. (CONF-861211—). American Society of Mechanical Engineers, 345 East 47 St., New York, NY 10017.

From American Society of Mechanical Engineers winter meeting; Anaheim, CA, USA (7 Dec 1986).

Technical Paper 86-WA/HT-4.

Two examples of alternate concepts for fusion reactors are the Compact Reversed-Field Pinch Reactor and the Advanced Tokamak Reactor based on the Spherical Torus. Both are compact reactors that have high-power-density cooling requirements for key fusion-power-core components. Both reactors have blankets cooled by Pb/sub 83/Li/sub 17/ eutectic and other components that are cooled by water. Thus, a dual-media steam power cycle must be used. Thermal/hydraulic analyses were developed for the design of the fusion-power-core components. A procedure was developed to optimize the design with respect to net cycle efficiency, subject to design constraints related to critical heat flux, peak temperatures, corrosion, and thermal stress. Details of the calculation procedures and results for the blanket designs for both conceptual reactors are given.

10597 **Steady-state and transient thermal hydraulics of a breeder-in-tube blanket design.** Grotz, S.P.; Ghoniem, N.M. New York, NY; American Society of Mechanical Engineers (1987). 8p. (CONF-861211—). American Society of Mechanical Engineers, 345 East 47 St., New York, NY 10017.

From American Society of Mechanical Engineers winter meeting; Anaheim, CA, USA (7 Dec 1986).

Technical Paper 86-WA/HT-5.

A new pin-type solid breeder blanket for tokamak reactors has been developed. Detailed engineering analyses have been performed and include configuration, neutronics, structural analysis, tritium transport, materials issues and thermal hydraulics. Steady-state and transient thermal problems have been addressed and are reported here. Particular attention is given to the issues of start-up, shutdown and fractional power operation. This study complements a previous report which examined the start-up, shutdown and fractional power operation of a liquid metal cooled tandem mirror reactor blanket 1.

10598 **Thermal-hydraulic limitations on water-cooled fusion reactor components.** Cha, Y.S.; Misra, B. New York, NY; American Society of Mechanical Engineers (1987). 8p. (CONF-861211—). American Society of Mechanical Engineers, 345 East 47 St., New York, NY 10017.

From American Society of Mechanical Engineers winter meeting; Anaheim, CA, USA (7 Dec 1986).

Technical Paper 86-WA/HT-6.

An assessment of the cooling requirements for fusion reactor components, such as the first wall and limiter/divertor, was carried out using pressurized water as the coolant. In order to establish the coolant operating conditions, a survey of the literature on departure from nucleate boiling, critical heat flux, asymmetrical heating and heat transfer augmentation techniques was carried out. The experimental data and the empirical correlations indicate that thermal protection for the fusion reactor components based on conventional design concepts can be provided with an adequate margin of safety without resorting to either high coolant velocities, excessive coolant pressures, or heat transfer augmentation techniques. If, however, the future designs require unconventional shapes or heat transfer enhancement techniques, experimental verification would be necessary since no data on heat transfer augmentation techniques exist for complex geometries, especially under asymmetrically heated conditions. Since the data presented herein are concerned primarily with thermal protection of the reactor components, the final design should consider other factors such as thermal stresses, temperature limits, and fatigue.

10599 **Nuclear data needs for fusion reactors.** Gohar, Y. (Argonne National Lab., IL, USA). *Radiation Effects;* 92: No. 1-4, 15-44(1986). (CONF-850507—).

From International conference on nuclear data for basic and applied science; Santa Fe, NM, USA (13 May 1985).

The paper reviews design issues and main fusion reactor parameters which impact the neutronics performance of the different reactor components. The nuclear data needs and deficiencies are emphasized. Tritium breeding requirements, tritium breeding potential of different blanket concepts, neutron multiplier materials, auxiliary heating and impurity control, inboard blanket in tokamak reactors, energy multiplication, radiation shielding, cross section uncertainty analysis, and nuclear data needs, are all discussed. (U.K.).

10600 **Hydrogen fusion-energy reactions.** Brown, R.E.; Jarmie, N. (Los Alamos National Lab., NM, USA). *Radiation Effects;* 92: No. 1-4, 45-58(1986). (CONF-850507—).

From International conference on nuclear data for basic and applied science; Santa Fe, NM, USA (13 May 1985).

The paper concerns measurements of the hydrogen fusion-energy reactions carried out at the Los alamos Ion Beam Facility. Data are presented on the D(t,α)n reaction, D(d,p)T and D(d,^{3}He)n reactions, as well as preliminary results for the T(t,α)nn reaction. (U.K.).

10601 **Fusion neutronics calculational benchmarks for basic nuclear data and transport codes intercomparison.** Yousef, M.; Jung, J.; Sawan, M. (California Univ., Los Angeles, USA. School of Engineering and Applied Science; Argonne National Lab., IL, USA; Wisconsin Univ., Madison, USA. Dept. of Nuclear Engineering). *Radiation Effects;* 92: No. 1-4, 117-122(1986). (CONF-850507—).

From International conference on nuclear data for basic and applied science; Santa Fe, NM, USA (13 May 1985).

Four calculational benchmarks have been selected to compare various nuclear data libraries based on both ENDF/B-IV and V, and to compare results from various transport codes. Discrepancies up to 20% in tritium production from ^{7}Li were found and have been attributed mainly to differences in current ENDF/B-IV and V evaluations while approx. 4% is attributed to differences in the group structure of the libraries used. Results from MCNP and VIM Monte Carlo codes are in good agreement but MORSE calculations show good agreement only for high threshold reactions.

10602 **Startup of large coil test facility.** Haubenreich, P.N.; Bohanan, R.E.; Fietz, W.A.; Luton, J.N.; May, J.R. (Oak Ridge National Lab., TN, USA). pp vp of Fusion technology 1984. Vol. 2. Proceedings of the 13. symposium held at Varese, Italy on 24-28 September 1984. Oxford, England; Pergamon Press (1984). (EUR—9183-EN; CONF-840915—). Contract AC05-84OR21400.

From 13. symposium on fusion technology; Varese, Italy (24 Sep 1984).

The Large Coil Test Facility (LCTF) is being used to test superconducting toroidal field coils about one-third the size of those for INTOR. Data were obtained on performance of refrigerator, helium distribution, power supplies, controls, and data acquisition systems and on the acoustic emission, voltages, currents, and mechanical strains during charging and discharging the coils.

10603 **Comparison of three ICF reactor designs.** Hogan, W.J. (Lawrence Livermore National Lab., CA, USA). pp vp of Fusion technology 1984. Vol. 2. Proceedings of the 13. symposium held at Varese, Italy on 24-28 September 1984. Oxford, England; Pergamon Press (1984). (EUR—9183-EN; CONF-840915—).

From 13. symposium on fusion technology; Varese, Italy (24 Sep 1984).

Three concepts for inertial confinement fusion (ICF) reactors are described and compared with each other, and with magnetic fusion and fission reactors on the basis of environmental impact, safety and efficiency. The critical technical developments of each concept are described. The three concepts represent alternative development paths for inertial fusion.

10604 **Performance of the Cascade inertial-confinement-fusion conceptual reactor.** Pitts, J.H. (Lawrence Livermore National Lab., CA, USA). pp vp of Fusion technology 1984. Vol. 2. Proceedings of the 13. symposium held at Varese, Italy on 24-28 September 1984. Oxford, England; Pergamon Press (1984). (EUR—9183-EN; CONF-840915—). Contract W-7405-ENG-48.

From 13. symposium on fusion technology; Varese, Italy (24 Sep 1984).

A 4.5-m-radius rotating fusion reactor made of silicon carbide and containing a moving 1-m-thick lithium-ceramic granular blanket can produce 3000 MWsub(t). The blanket operates at high temperature (>1200 K) leading to gross plant efficiencies of up to 60% using a combined helium-gas turbine (Brayton cycle) with a vapor bottoming cycle.

99 GENERAL AND MISCELLANEOUS

10605 **(ANL/TM—429-Rev.1) Computing services writing and editing standards.** Caruthers, C.M.; Heiberger, A.A. (Argonne National Lab., IL (USA)). Nov 1987. Contract W-31109-ENG-38. 74p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE88003446/JAW.

Computing Services Writing and Editing Standards explains how to write and organize technical information clearly and con-

cisely; it also establishes Argonne National Laboratory Computing Services standards for grammar, usage, style, formats, and publication procedures. This manual will enable writers to produce better documents consistent with Computing Services standards in less time. Applying the specified principles will also speed up the editing, review, and revision processes.

10606 **(CONF-8710184—4) General employee training: Course development and implementation.** White, D.A.; Copenhaver, E.D. (Oak Ridge National Lab., TN (USA)). 1987. Contract AC05-84OR21400. 10p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88001729/JAW.

From 11. annual Training Resources and Data Exchanges (TRADE) conference; Atlanta, GA, USA (26 Oct 1987).

A checklist is presented which may be useful in development and implementation of general employee training (GET) in a large facility operation. The ideas behind formulation of the checklist are discussed and illustrated with examples from GET experience at the Oak Ridge National Laboratory.

10607 **(DOE/S—0010(86)) Annual report to Congress.** (USDOE Office of the Secretary, Washington, DC). 1986. 269p. NTIS, PC A12/MF A01; 1; GPO Dep. Order Number DE88002996/JAW.

This report covers the activities of the Department from the publication of the 1985 Annual Report to Congress through 1986. Activities of all elements of the Department except the Federal Energy Regulatory Commission are included herein. During this period, activities for the Environmental Survey of facilities were finalized, the onsite studies by DOE Survey teams were inaugurated, and Technical Safety Appraisals of our nuclear facilities were performed. The Strategic Petroleum Reserve surpassed the 500-million-barrel milestone, and a successful market test of the Reserve's drawdown and distribution capability and sale of one million barrels of oil were completed. Particular attention was directed toward coal research and acid rain-related technologies. Work continued in petroleum and unconventional natural gas recovery. The focus in conservation research and development, as well as renewable activities, was to assist the private sector by expanding the technology base. DOE-supported research in high energy and nuclear physics continued. The Department supported basis scientific research in the fields of materials, nuclear and applied mathematical science, engineering and geosciences, biological science, advanced energy projects and magnetic fusion energy; and research on the effects of energy systems on biological and environmental processes and on the use of nuclear materials in medical diagnosis and treatment continued. Internationally, we continued efforts in the International Atomic Energy Agency. The Department's responsibilities for national security included weapons research, development, and testing, as well as the improvement of safeguards and security at production facilities. The Department also continued to pursue a variety of activities to dispose of high-level radioactive waste and spent nuclear fuel.

9901 Management

10608 **(DOE/MA—0284) PGMO 5, Program execution and evaluation: Unit 5 of the program management technical skills training program.** (USDOE Assistant Secretary for Management and Administration, Washington, DC. Employee Development and Training Div.). Nov 1987. 512p. NTIS, PC A22/MF A01; 1; GPO Dep. Order Number DE88003231/JAW.

This document is made up of a series of technical notes, workshops, and view-graph hard copies. The first note describes general policy concerning DOE program management. The second note is a description of NASA program and project management. The next two notes describe the results of studies of research and development evaluation activities inside and outside DOE. Since there is no DOE-wide R and D evaluation system, these notes provide a background view of how program managers and field managers might function in program evaluation. The final note is a copy of the DOE CSCSC Implementation Guide, which describes how earned value analysis is accomplished in various project and operating situations in the field.

10609 **(SAND—87-2744C) How to avoid massive retraining efforts through strategic needs assessment.** Holley, B.M. (Sandia National Labs., Albuquerque, NM (USA)). 1987. Contract AC04-76DP00789. 4p. (CONF-8702117—1). NTIS, PC A02. Order Number DE88002510/JAW.

From College industry education conference; San Diego, CA, USA (8 Feb 1987).

During the past thirty years, the character of Sandia National Laboratories has changed enough that today less than three-fourths of our work is in research and development of nuclear weapons. This paper describes the educational needs assessment used by the education organization to strategically establish curricula. It also explains how this method can be used effectively to reduce large retraining efforts as the character of the work force and the Laboratories evolves.

10610 **(ZfK—602) 30 years of Central Institute for Nuclear Research at Rossendorf.** Scheler, W.; Flach, G.; Hennig, K.; Collatz, S.; Muenze, R.; Baldeweg, F. (Zentralinstitut fuer Kernforschung, Rossendorf bei Dresden (German Democratic Republic)). Oct 1986. 52p. (In German). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88700944/JAW.

A celebration and a scientific colloquium dedicated the 30th anniversary of the foundation of the Central Institute for Nuclear Research (CINR) of the GDR Academy of Sciences were held on January, 23rd and 24th, '86 at Rossendorf. The speaches and lectures given by the president of the GDR Academy of Sciences and by scientists of the CINR dealt with problems of policy of science, history of the CINR, nuclear methods, microelectronics, nuclear energy research, development and production of radioisotopes and scientific instruments.

10611 **Second nuclear era: prospects and perspectives.** Weinberg, A.M. (Oak Ridge Associated Universities, Inc., TN, USA. Inst. for Energy Analysis). *Radiation Effects;* 92: No. 1-4, 5-12(1986). (CONF-850507—).

From International conference on nuclear data for basic and applied science; Santa Fe, NM, USA (13 May 1985).

The prospects and perspectives for a second nuclear era are reviewed. The present state of nuclear power, the first nuclear era, technology and institutions, the safety of light water reactors, active and passive safety, and inherently safe reactors, are all discussed. (U.K.).

9902 Mathematics And Computers

REFER ALSO TO CITATION(S) 9316

10612 **(ANL—87-46) Application of a multigrid method to a buoyancy-induced flow problem.** Thompson, C.P.; Leaf, G.K.; Vanka, S.P. (Argonne National Lab., IL (USA)). Oct 1987. Contract W-31109-ENG-38. 31p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88003961/JAW.

The numerical prediction of buoyancy-induced flows provides special difficulties for standard numerical techniques associated with velocity-buoyancy coupling. We present a multigrid algorithm based upon a novel relaxation scheme that handles this coupling correctly. Numerical experiments have been performed that show that this approach is reasonably efficient and robust for a range of Rayleigh numbers and a variety of cycling strategies. 12 refs., 4 figs., 4 tabs.

10613 **(ANL/MCS-TM—97) Prospectus for the development of a linear algebra library for high-performance computers.** Demmell, J.; Dongarra, J.J.; Du Croz, J.; Greenbaum, A.; Hammarling, S.; Sorensen, D. (Argonne National Lab., IL (USA)). Sep 1987. Contract W-31109-ENG-38. 10p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88003715/JAW.

We propose to design and implement a transportable linear algebra library in Fortran 77 for efficient use on high-performance computers. The library is intended to provide a uniform set of subroutines to solve the most common linear algebra problems and to

run efficiently on a wide range of architectures. This library, which will be freely accessible via computer network, not only will ease code development, make codes more portable among machines of different architectures, and increase efficiency, but also will provide tools for evaluating computer performance. The library will be based on the well-known and widely used LINPACK and EISPACK packages for linear equation solving, eigenvalue problems, and linear least squares. LINPACK and EISPACK have provided an important infrastructure for scientific computing on serial machines, but they were not designed to exploit the profusion of parallel and vector architectures not becoming available. We propose to restructure the algorithms in terms of calls to a small number of extended Basic Linear algebra Subroutines each of which implements a basic operation such as matrix multiplication, rank-k matrix updates, and the solution of triangular systems. These operations can be optimized for each architecture, but the underlying numerical algorithms will be the same for all machines. 11 refs.

10614 **(CONF-870677—11) Preconditioned iterative methods for partial differential equations.** Leaf, G.K.; Minkoff, M.; Diaz, J.C. (Argonne National Lab., IL (USA); Oklahoma Univ., Norman (USA). Parallel Processing Inst.). 1987. Contract W-31109-ENG-38. 6p. NTIS, PC A02. Order Number DE88003071/JAW.

From 6. IMACS international symposium on computer methods for partial differential equations; Bethlehem, PA, USA (23 Jun 1987).

In this paper we consider several preconditioners and iterative methods for solving the linear algebraic system associated with a partial differential equation. Our interest stems from earlier work in Method of Lines (MOL) software for solving kinetics-diffusion equations and a recognition that the solution of the underlying linear system at each timestep is crucial in terms of computational storage and time. We are interested in developing an approach to handle nonsymmetric matrices so that we can deal with convective terms in the partial differential equation (PDE). To examine our methods we consider a model problem which has been used in related work. With regard to the approach there are two aspects: the preconditioner and the iterative method. Among the preconditioners considered are normal form LU factorization and variations related to approximate inverses. The iterative methods include normal form conjugate gradients and related nonsymmetric methods (ORTHOMIN and ORTHODIR). We have found that the use of either an approximate LU factorization or an approximate inverse in combination with normal form conjugate gradient iteration provides an effective approach for solving our model problem. This result suggests potential use of approximate inverses for parallel computation. 5 refs., 4 figs.

10615 **(CONF-8610302—1) On line search termination criteria for and convergence of conic algorithms for minimization.** Ariyawansa, K.A. (Washington State Univ., Pullman (USA). Dept. of Pure and Applied Mathematics). 1986. Contract FG06-85ER25007. 3p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88002844/JAW.

From 24. annual Allerton conference on communication, control and computing; Monticello, IL, USA (1 Oct 1986).

This report presents an implementable class of collinear scaling algorithms for unconstrained minimization. A member of this class that extends the BFGS method does possess desirable properties similar to those shown for the BFGS method by Powell (1976). However, a major drawback is that in order to guarantee q-superlinear convergence, a parameter in the algorithm must be set to a value which depends on F. 8 refs.

10616 **(CONF-8707135—1) Norm inequalities for derivatives and differences.** Kwong, Man Kam; Zettl, A. (Northern Illinois Univ., Dekalb (USA). Dept. of Mathematical Sciences; Argonne National Lab., IL (USA)). 1987. Contract W-31109-ENG-38. 32p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88002920/JAW.

From International conference on inequalities; Birmingham, UK (13 Jul 1987).

Norm inequalities of product form relating a function and two of its derivatives and a sequence and two of its differences are discussed and compared. This paper contains a discussion of the possible values of the p and q norms of a function y and its n/sup th/ derivative y/sup (n)/. Detailed elementary proofs of the basic inequality for functions and a number of related inequalities are also given. A discussion of the growth at infinity of derivatives and a summary of cases when the best constant is known explicitly for both the continuous and the discrete versions of the basic inequality are finally discussed. 85 refs., 2 figs., 1 tab.

10617 **(CONF-8708128—2) Numerical solution of bound constrained problems.** More, J.J. (Argonne National Lab., IL (USA)). 1987. Contract W-31109-ENG-38. 8p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE88002831/JAW.

From International symposium on computational fluid dynamics and international conference on computational techniques and applications; Sydney, Australia (24 Aug 1987).

We are interested in the numerical solution of minimization problems subject to bound constraints. Algorithms for solving these problems usually restrict the change in the dimension of the working subspace by only dropping or adding one constraint at each iteration. This implies that if there are k_1 constraints active at the solution and k_2 constraints active at the starting point, then at least absolute value of $k_2 - k_1$ iterations are required for convergence. For large scale problems this can be a serious disadvantage. In contrast, algorithms based on the gradient projection algorithm are able to drop and add many constraints at each iteration. This ability gives them an important advantage in large scale problems. The emphasis in this paper is on the application of gradient projection techniques to the numerical solution of bound constrained problems. Our aim is to present and motivate some techniques which show promise; references are given to more exhaustive treatments of these techniques. 17 refs.

10618 **(DOE/ER/02075—T1) [Imegration of numeric and symbolic techniques for scientific computation]: Final progress report.** Varga, R.S.; Wang, P.S. (Kent State Univ., OH (USA). Inst. of Computational Mathematics). 28 Sep 1987. Contract AC02-76ER02075. 10p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88002725/JAW.

10619 **(FNAL-TM—1481) Software support: Pre-empting the quick question.** Loebel, L. (Fermi National Accelerator Lab., Batavia, IL (USA)). Sep 1987. Contract AC02-76CH03000. 6p. (CONF-8709195—1). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88002833/JAW.

From 15. ACM SIGUCCS user services conference; Kansas City, MO, USA (27 Sep 1987).

High energy physicists, researchers and graduate students, from universities all around the world come to Fermi National Accelerator Laboratory to do their experiments. They use our computer facilities to perform all phases of their data-analysis and presentation. We have a large turnover of users and a rather small support group, in a multi-vendor environment. We strive to make our users self-sufficient through the use of well-publicized maintenance procedures, documentation systems, and product support standards. By these pre-emptive measures we attempt to have quick answers at hand for the truly quick questions, leaving us time for the interesting problems.

10620 (INIS-mf—11052, pp vp) **Computer programs for experiments on SPIN facility.** Fominykh, M.I. (Joint Inst. for Nuclear Research, Dubna, USSR). 1985. (In Russian). NTIS (US Sales Only), PC A19/MF A01. Order Number DE88700667/JAW. (CONF-8509430—).

From International summer school on hyperfine interactions and international study meeting: physics with oriented nuclei; Bechyne, Czechoslovakia (2 Sep 1985).

10621 **(LPC—87-05) User book of SPAD software.** Eschylle, R. (College de France, 75 - Paris. Lab. de Physique Corpusculaire). 1987. 28p. (In French). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88751761/JAW.

Data-gathering and accumulation is swelling in any domain thanks to computer science. A data analysis is aimed at extraction of useful data easily readable for the user. Among the mathematical

methods used three of them are developed in the Spad software: - principal component analysis, - factorial analysis of simple correspondence, - factorial analysis of multiple correspondence. Data tables are first defined in this paper together with terms used by statisticians. Then the user manual describes the six analysis steps (or modules) included in the program, the links of steps which give classical data analysis. At last, for each step an "using notice" is given which describes the step parameters after some comments on the step object.

10622 **(MLM—3444) Remarks on the operational method of data treatment.** Silver, G.L. (Monsanto Research Corp., Miamisburg, OH (USA). Mound). 30 Nov 1987. Contract AC04-76DP00053. 20p. NTIS, PC A03/MF A01; GPO Dep. Order Number DE88003444/JAW.

The operational method for data interpolation is not suitable for problems in three dimensions because too many points are involved. Alternative interpretations of the operational technique are suggested, and new formulas for derivatives on curvilinear data are presented. 3 refs., 1 tab.

10623 **(N—87-29124) Proceedings: Computer science and data systems technical symposium, volume 1.** Larsen, R.L.; Wallgren, K. (National Aeronautics and Space Administration, Washington, DC (USA)). Aug 1985. vpp. (NASA-TM—89285; NAS—1.15:89285). NTIS, PC A16/MF A01.

Progress reports and technical updates of programs being performed by NASA centers are covered. Presentations in viewgraph form are included for topics in three categories: computer science, data systems and space station applications.

10624 (N—87-29124, pp vp) **ICASE computer science program.** Aug 1985. NTIS, PC A16/MF A01. (NASA-TM—89285; NAS—1.15:89285).

In Proceedings: Computer Science and Data Systems Technical Symposium, volume 1.

The Institute for Computer Applications in Science and Engineering computer science program is discussed in outline form. Information is given on such topics as problem decomposition, algorithm development, programming languages, and parallel architectures.

10625 **(N—87-29144) Proceedings: Computer science and data systems technical symposium, volume 2.** Larsen, R.L.; Wallgren, K. (National Aeronautics and Space Administration, Washington, DC (USA)). Aug 1985. vpp. (NASA-TM—89286; NAS—1.15:89286). NTIS, PC A17/MF A01.

Progress reports and technical updates of programs being performed by NASA centers are covered. Presentations in viewgraph form, along with abstracts, are included for topics in three catagories: computer science, data systems, and space station applications.

10626 **(ORNL/TM—10246) Conversion of productions in OPS5 to their equivalent English.** Wertheimer, S.J.; Baird, B.B.; Gove, N.B. (Connecticut Coll., New London (USA); Oak Ridge National Lab., TN (USA)). Oct 1987. Contract AC05-84OR21400. 52p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE88003667/JAW.

A computer program has been written to provide English language versions of reactor analysis logic in OPS5. The present version, written in Prolog (a computer language designed for logic and language parsing), produces an English narrative translation of an individual OPS5 production rule. The translation is in two steps and involves an intermediate format consisting of Prolog-readable data statements. Translation to other languages or to other forms of English would not, therefore, require changing the first step. Samples are shown for OPS5 production rules related to the High Flux Isotope Reactor Intelligent Advisor Project. The Prolog programs also are shown. 2 refs.

10627 **(ORNL/TM—10616) An investigation of very high level languages and their implementation on a Forth language microprocessor.** Arnold, H.G.; Dress, W.B.; Loffman, R.S. (Oak Ridge National Lab., TN (USA)). Nov 1987. Contract AC05-84OR21400. 58p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE88003703/JAW.

The potential for using a Forth language microprocessor to implement very high level languages (VHLLs) in Artificial Intelligence research was investigated by surveying the current state-of-the-art of VHLLs, by benchmarking several computers and microcomputers against a customized Forth Language microprocessor, and by extrapolating the results to draw conclusions about implementing expert systems on the Forth language microprocessor. 20 refs., 6 figs., 1 tab.

10628 **(SLAC-PUB—4258) Programming languages: Time for a change?.** Russell, J.J. (Stanford Linear Accelerator Center, Menlo Park, CA (USA)). Mar 1987. Contract AC03-76SF00515;AC02-76ER02220. 6p. (CONF-870249—12). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88003611/JAW.

From Computing high energy physics; Pacific Grove, CA, USA (2 Feb 1987).

An overview of the software needs of the high-energy physics community and how modern languages can meet these needs is given. Using ADA as an example, the production of readable, efficient and maintainable code is shown to be directly supported by the language, integrating concepts such as top-down design, object-oriented programming and data encapsulation as a natural part of the language rather than as foreign ideas imposed on the language. Particular attention is paid to nontraditional aspects of a language and how these can help by providing an integrated support environment for all phases of the lifetime of the software. 2 refs.

10629 **(UCID—21238) Choice of Ada programming language for the Conflict Model (ConMod).** Tannahill, J.R.; Simonson, S.C. (Lawrence Livermore National Lab., CA (USA)). 23 Oct 1987. Contract W-7405-ENG-48. 24p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88003726/JAW.

The Ada programming language was chosen for the Conflict Model (ConMod). ConMod is under development in the Conflict Simulation Center as a high-resolution, large-scale, automated, echelon-above-corps conflict simulation. The project has joint LLNL and Army sponsorship and Air Force participation. To make the language decision, the Kepner-Tregoe decision analysis method was employed. Sets of mandatory (MUST) objectives and desirable (WANT) objectives were established by the project team. Language features that support modern software engineering practices were a primary concern, along with benefits to the eventual ConMod user and aids in program implementation. The initial target machine for the model is the VAX 8800 running the VMS operating system. Six languages were considered. In the order in which they ranked against the WANTS, they were: DEC Ada, DEC Pascal, Logitech Modula-2, DEC FORTRAN, DEC C, and CACI Simscript II.5. Potential adverse consequences of the selection were also considered for the first three. No inhibitory problems were found for the first choice, DEC Ada, and consequently it was adopted. 13 refs.

10630 **(UCID—21251) TOPP: A post-processor for TOPAZ, the one dimensional pipe flow analysis code.** Martin, R.W. (Lawrence Livermore National Lab., CA (USA)). Jul 1987. Contract W-7405-ENG-48. 8p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE88003711/JAW.

TOPP is a Lawrence Livermore National Laboratory (LLNL) post-processor for producing graphical results from the one dimensional pipe flow analysis code, TOPAZ. TOPAZ was written by W. S. Winters of Sandia National Laboratory, Livermore (SNLL) and is available on the CRAY computers at LLNL. The SNLL version of TOPAZ produces a very limited set of variables that can be used as input to a post-processor. The version at LLNL has been modified to output every time-dependent variable to an absolute binary file at the user specified minor edit frequency.

TOPP reads this absolute binary file and produces a variety of graphical results. 2 refs.

10631 **(UCRL—96781) Applicative parallelism: Potential and challenge.** Oldehoeft, R.R.; Cann, D.C. (Lawrence Livermore National Lab., CA (USA)). 8 Jun 1988. Contract W-7405-ENG-48. 26p. (CONF-880114—1). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE87011885/JAW.

From Hawaii international conference on systems sciences; Kailua-Kona, HI, USA (5 Jan 1988).

The applicative model of computation makes possible the development of programming languages with several attractive features. Programs may be proved to execute correctly. Features of these languages remove some sources of programmer error, and can make correct programs easier to build and maintain. In this report we discuss how software for applicative language programs can automatically detect and exploit parallelism to take advantage of current and future parallel processing systems. We use an applicative language, SISAL, to show the sources of parallelism. A prototype SISAL system is available to execute some sample programs and help us examine how well the implementation exploits potential parallelism. An outstanding problem in applicative language design and implementation is copy optimization. The single assignment semantics of these languages requires frequent data structure copying in some programs. We exemplify the importance of doing this optimization well, and show that high-quality code generation is also important for applicative languages. 27 refs., 7 figs., 1 tab.

10632 **(UCRL—97609) Some properties of the Hilbert transform.** Goodman, D.M. (Lawrence Livermore National Lab., CA (USA)). Nov 1987. Contract W-7405-ENG-48. 5p. (CONF-871162—3). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88002465/JAW.

From 21. annual Asilomar conference on signals, systems, and computers; Pacific Grove, CA, USA (2 Nov 1987).

The derivatives of the operation of stabilizing a multidimensional sequence are calculated. This calculation is based on the Frechet derivative and some properties of the cepstrum. The implications for the design of recursive filters are discussed. These results may also be useful in the one-dimensional case. 14 refs.

10633 **The use of BLAS3 in linear algebra on a parallel processor with a hierarchical memory.** Gallivan, K.; Jalby, W.; Meier, U. (Center for Supercomputing Research and Development, Univ. of Illinois, Urbana, IL 61801). *SIAM Journal on Scientific and Statistical Computing;* **8**: No. 6, 1079-1084(Nov 1987).

This note describes work at CSRD which shows that a third level of the BLAS (BLAS3) is needed to achieve high-performance on multivector processors with a shared hierarchical memory.

10634 **Courant-like conditions limit reasonable mesh refinement to order h/sup 2/.** Swartz, B. (Theoretical Div., Univ. of California, Los Alamos National Lab., Los Alamos, NM 87545). *SIAM Journal on Scientific and Statistical Computing;* **8**: No. 6, 924-933(Nov 1987).

Under conditions (e.g., Courant-Friedrichs-Lewy conditions) on the size of all location time steps-namely, that they be proportional to the local spatial mesh size - a mesh refinement algorithm cannot be a "reasonable" algorithm if, near some space-time surface, the spatial mesh is refined to size o(h/sup 2/), i.e., smaller than order h/sup 2/. Here h typifies the mesh size over most of the spatial region; and an algorithm is called "unreasonable" if, asymptotically, it spends all of its computational work exercising at the space-time surface. The limitation is even more stringent for problems with more than one spatial dimension unless the refinement occurs only normal to the surface. As the local time step constraints may be imposed for reasons of accuracy or efficiency as well as for stability, they may differ, on the coarse or fine meshes, from Courant-like conditions. In that case, the limitations on the order of reasonable refinement will generally change. But there is an absolute limitation which depends on the time step restriction away from the surface and on the number of spatial dimensions. One consequence of all this appears to be that o(h/sup 4/) errors are unattainable in vast regions of space-time utilizing reasonable mesh refinement - at least when using more or less uniformly applied difference schemes, with Courant-like conditions, to approximate those solutions of hyperbolic systems whose first derivatives or values jump at some surface in space-time.

10635 **Symbolic factorization for sparse Gaussian elimination with partial pivoting.** George, A.; Ng, E. (Dept. of Computer Science and Mathematics, Univ. of Tennessee, Knoxville, TN 37996). *SIAM Journal on Scientific and Statistical Computing;* **8**: No. 6, 877-898(Nov 1987).

Let Achi = b be a large sparse nonsingular system of linear equations to be solved using Gaussian elimination with partial pivoting. The factorization obtained can be expressed in the form A = P/sub 1/M/sub 1/P/sub 2/M/sub 2/ . . . P/sub n-1/M/sub n-1/U, where P/sub κ/ is an elementary permutation matrix reflecting the row interchange that occurs at step κ during the factorization. , M/sub κ/ is a unit lower triangular matrix whose κth column contains the multipliers, and U is an upper triangular matrix. Consider the κth step of the elimination. Suppose we replace the structure of row κ of the partially reduced matrix by the union of the structures of those rows which are candidates for the pivot row and then perform symbolically Gaussian elimination without partial pivoting. Assume that this is done at each step κ, and let L-bar and U-bar denote the resulting lower and upper triangular matrices, respectively. Then the structures of L-bar and U-bar, respectively, contain the structures of Σ/sub κ=1//sup n-1/ M/sub κ/ and U. This paper describes an algorithm which determines the structures of L-bar and U-bar, and sets up an efficient data structure for them.

10636 **A note on sparse factorization in a paging environment.** Liu, J.W.H. (Dept. of Computer Science, York Univ., North York, Ontario M3J 1P3). *SIAM Journal on Scientific and Statistical Computing;* **8**: No. 6, 1085-1088(Nov 1987).

The impact of reordering on the Cholesky factorization of a sparse matrix in a paging environment is examined. The authors show experimentally that an equivalent reordering, if appropriately chosen, can reduce the CPU time and elapsed time for sparse factorization.

10637 **Calculating Fourier transforms of long-tailed functions.** Lyness, J.N.; Kaper, T.J. (Mathematics and Computer Science Div., Argonne National Lab., Argonne, IL 60439-4844). *SIAM Journal on Scientific and Statistical Computing;* **8**: No. 6, 1005-1011(Nov 1987). Contract W-31-109-ENG-38.

In this paper, the authors describe a method for evaluating Fourier Transform functions numerically when function values f(chi) are available for any value of chi. Their method is based on the Mobius inversion of the Poisson summation formula, and employs a nonlinear series acceleration technique. Numerical evidence suggests that, for relatively smooth functions having long tails, this approach may be very useful.

10638 **Computed tomography for quantitative NDE.** Streit, R.D.; Clark, G.A.; Brase, J.M. (Lawrence Livermore National Lab., Livermore, CA). *Mechanical Engineering;* **109**: No. 9, 56-65(Sep 1987). Contract W-7405-ENG-48.

The authors discuss how computed tomography (CT) can be used for nondestructive evaluation (NDE) to retrieve three-dimensional information that is lost in standard radiographic imaging. The article explains the work the authors have done in quantitative film radiography and how computers reconstruct the CT image. They are currently studying how to obtain CT images quicker than in the past to make CT more useful.

10639 **The beta equilibrium, stability, and transport codes. Applications to the design of stellarators.** Bauer, F.; Garabedian, P.; Betancourt, O.; Wakatani, M. Orlando, FL; Academic Press Inc. (1987). 200p. Academic Press Inc., Orlando, FL 32887.

This book gives a detailed exposition of the available computational methods, documents the codes, and presents many examples showing how to run them and how to interpret the results. A listing of the recently completed BETA transport code is included. Current stellarator experiments are discussed, and the book contains significant appiications to the design of major new stellarator experiments that are now in the planning stage.

10640 **Hypercube ensembles: An architecture for intelligent robots.** Barhen, J. (Center for Engineering Systems Advanced Research, Oak Ridge National Lab., P.O. Box X, Oak Ridge, TN 37831). pp 195-234 of Computer architecture for robotics and automation. Graham, J.H. New York, NY; Gordon and Breach Science Publishers Inc. (1987).

The advent of VLSI technology, and its implementation in the design of a new generation of computer systems involving a high degree of concurrency, is opening tremendous opportunities for a wide spectrum of applications which require 'supercomputing' capabilities. The authors focus on hypercube ensembles a revolutionary advance in the expanding domain of concurrent computation machines. Critical issues in the development of algorithms for such message-passing architectures are addressed in the context of intelligent autonomous systems, with emphasis on task scheduling and load balancing. They also present the detailed implementation of the Newton-Euler inverse dynamics equations for a robot manipulator on the NCUBE supersystem.

10641 **Analysis of neutron data in the resonance region via the computer code SAMMY.** Larson, N.M. (Oak Ridge National Lab., TN, USA). *Radiation Effects;* **96**: No. 1-4, 191-194(Mar 1986). (CONF-850507—). Contract AC05-84OR21400.

From International conference on nuclear data for basic and applied science; Santa Fe, NM, USA (13 May 1985).

Procedures for analysis of resonince neutron cross-section data have been implemented in a state-of-the-art computer code SAMMY, developed at the Oak Ridge Electron Linear Accelerator (ORELA) at Oak Ridge National Laboratory. A unique feature of SAMMY is the use of Bayes' equations to determine "best" values of parameters, which permits sequential analysis of data sets (or subsets) while giving the same results as would be given by a simultaneous analysis. Another important feature is the inclusion of data-reduction parameters in the fitting procedure. Other features of SAMMY are also described.

10642 **Advances and trends in parallel algorithms.** Rodrigue, G. (Lawrence Livermore National Lab., Livermore, CA). pp 37-48 of Computational mechanics: Advances and trends. Noor, A.K. New York, NY; American Society of Mechanical Engineers (1986). (CONF-861211—).

From American Society of Mechanical Engineers winter meeting; Anaheim, CA, USA (7 Dec 1986).

In this paper, three new ideas are presented for developing parallel numerical techniques to solve problems associated with large scale scientific computing.

10643 **A high speed multi-channel data recorder to replace oscilloscope data acquisition systems.** Lockwood, G.J.; Chang, J.; Filter, W.F.; Landron, C.O.; Muron, D.J.; Neyer, B.T.; Ruggles, L.E. (Sandia National Labs., Div. 1234, P.O. Box 5800, Albuquerque, NM 87185). pp 172-178 of Fiber optic and laser sensors III. Moore, E.L.; Ramer, O.G. Bellingham, WA; SPIE Society of Photo-Optical Instrumentation Engineers (1985). (CONF-850887—). Contract AC04-76DP00789.

From SPIE international technical symposium on optical and electro-optical engineers; San Diego, CA, USA (18 Aug 1985).

The authors have developed and tested a photonic high speed analog data recording system that, when compared with conventional oscilloscope-based systems, offers greater economy, higher bandwidth, electrical isolation, and compactness. The basis of this approach is to record analog photonic signals rather than analog electrical signals. A key component is a prototype High Speed Multi-Channel Data Recorder (HSMCDR). It uses a picosecond streak camera with a digital readout to record multiple fiber-optic data channels, and a dedicated microcomputer to reduce and process that data. To record signals from analog electrical sensors, laser diode transmitters provide an interface to the HSMCDR. Interactive software written for the HSMCDR separates, calibrates, and plots up to 20 waveforms in the customary amplitude versus time format. The authors describe the HSMCDR, its performance, applications in pulsed power experiments, and its impact in diagnostic technology.

10644 **Development of a photonic data recorder.** Davis, H.P.; Allen, G.R.; Chang, J. (Div. 1234, Sandia National Labs., P.O. Box 5800, Albuquerque, NM 87185). pp 179-184 of Fiber optic and laser sensors III. Moore, E.L.; Ramer, O.G. Bellingham, WA; SPIE Society of Photo-Optical Instrumentation Engineers (1985). (CONF-850887—).

From SPIE international technical symposium on optical and electro-optical engineers; San Diego, CA, USA (18 Aug 1985).

In conjunction with the authors implementation of photonic diagnostics on pulsed power accelerators at Sandia, they are developing a Photonic Data Recorder (PDR) which sweeps and records photon analog signals directly rather than converting photons to electrons and sweeping the electrons, as in a conventional oscilloscope or streak camera.

9903 Information Handling

REFER ALSO TO CITATION(S) 8669, 10176, 10200, 10237, 10599, 10601

10645 (CONF-8611101—, pp 11, Paper 1) **Optical character reader technology.** Wrenn, T.T.; Harper, J.R. (EG & G WASC, Inc., Morgantown, WV). 1986. NTIS, PC A11/MF A01. Order Number DE88000230/JAW.

From 14. annual conference of the Department of Energy/Contractors Micrographics and Information Management Association; Pleasanton, CA, USA (4 Nov 1986).

The first Optical Character Readers (OCR's), introduced in the 1950's, were complex, expensive, and could read only a limited number of type fonts. Spinning mirrors and rotating drums were used to scan source documents. These electro-mechanical scanning devices gave way to CRT-based systems in the 1960's, but OCR's were still very expensive. It was not until the introduction of Charge Coupled Device (CCD) image sensors in the 1970's that OCR's became economical for use in small- to medium-sized word processing operations. The Morgantown Energy Technology Center's Word Processing Center used an OCR in the 1970's but found it unsatisfactory in terms of cost and performance. A new OCR, employing CCD image sensor technology, was leased in 1985 and has been very successful. This paper looks at how changes in image scanning technology have resulted in OCR's that are vastly improved in terms of cost, performance, size, and reliability. These improvements are discussed in terms of the effect that they have had in the Morgantown Energy Technology Center's Word Processing Center. 19 references.

10646 (CONF-8611101—, pp 41, Paper 2) **Using bar-code technology to enhance classified-document accountability.** Mountain, P.J.; Wade, D.J. (Martin Marietta Energy Systems, Inc., Oak Ridge, TN). 1986. NTIS, PC A11/MF A01. Order Number DE88000230/JAW. Contract AC05-84OR21400.

From 14. annual conference of the Department of Energy/Contractors Micrographics and Information Management Association; Pleasanton, CA, USA (4 Nov 1986).

This paper describes a system of resources and procedures coordinated to improve a classified-document inventorying process. The Bar Code Document Accountability System (BARDAS) was developed to demonstrate the feasibility of improving the management and reporting timeliness of secret document inventories by the accountable custodians. the paper discusses the reasons for the development method, the extensive error-checking, the degree of user-friendliness, and the use of bar-code technology in accomplishing these goals. Finally, the reactions of users to the system and future plans for enhancement are discussed. 19 figures.

10647 (CONF-8611101—, pp 11, Paper 3) **Project control and bar codes.** Beasley, L.M.; Saalborn, O.E. (Westinghouse Idaho Nuclear Co., Inc., Idaho Falls). 1986. NTIS, PC A11/MF A01. Order Number DE88000230/JAW.

From 14. annual conference of the Department of Energy/Contractors Micrographics and Information Management Association; Pleasanton, CA, USA (4 Nov 1986).

This paper presents a case study for the application of bar coding to a nuclear construction project. Early planning for the integration of bar-code methods for controlling information during

plant construction, startup testing, and operation will yield maximum benefit at lowest cost. A novel approach to the feasibility study, through the use of functional procedures, is presented and resulting cost/benefit analysis projections for the selected applications are given. 3 references, 10 figures, 2 tables.

10648 (CONF-8611101—, pp 28, Paper 4) **Computer-assisted retrieval at Los Alamos (CARLA): an update.** Garcia, L. (Los Alamos National Lab., NM). 1986. NTIS, PC A11/MF A01. Order Number DE88000230/JAW.

From 14. annual conference of the Department of Energy/ Contractors Micrographics and Information Management Association; Pleasanton, CA, USA (4 Nov 1986).

There is no text as such but copies of the following slides are included: History of CARLA I; problems with CARLA I; New CARLA (CARLA II); Phases of Development of CARLA II; Levels of Security applied on CARLA II; Migration of Documents; Functions of CARLA II; CARLA II consists of:; General Concept of how BASIS works; BASIS has provided CARLA with:; advantages of CARLA II; and Future Enhancements. In addition, there are 12 other figures showing entry forms; field names; look items; and plots of document inputs, July 1985-December 1986.

10649 (CONF-8611101—, pp 29, Paper 5) **Computer-aided retrieval of vital records.** Johnson, S. (Nuclear Fuel Services Inc., Erwin, TN). 1986. NTIS, PC A11/MF A01. Order Number DE88000230/JAW.

From 14. annual conference of the Department of Energy/ Contractors Micrographics and Information Management Association; Pleasanton, CA, USA (4 Nov 1986).

First, a vital record is defined as any record necessary to the survival and/or continued operation of the organization; arbitrarily, here, if there is a requirement to retain a document one year or more beyond its system - utilization life cycle, each such document is considered a vital record. Policy further establishes identification, record redundancy, centralization, and final disposition. Retention decision must conform to the following: contractual and financial commitments; government regulation; payable and receivable history; employee history; and other good business practices. Setting the system requirements and selections of a computer system are then discussed briefly, including the guidelines and standards for computer-aided retrieval. Hardware technicals are presented briefly. 20 figures.

10650 (CONF-8611101—, pp 8, Paper 6) **Problems of storing nonlinear documentation.** Grow, G.R. (Lawrence Livermore National Lab., CA). 1986. NTIS, PC A11/MF A01. Order Number DE88000230/JAW.

From 14. annual conference of the Department of Energy/ Contractors Micrographics and Information Management Association; Pleasanton, CA, USA (4 Nov 1986).

Nonlinear documentation is a powerful, interactive form of information handling. Unlike paper documents, which are linear and static by nature, nonlinear documentation allows active linkages within and among documents, can provide various levels of complexity to be viewed at will, and can include multimedia attributes, such as color, sound, and animated graphics. Traditional methods of providing long-term storage for paper documents are, like the documents themselves, static in nature. New storage technique will probabiy have to be devised to adequately preserve nonlinear documentation over long periods of time. 1 reference.

10651 (CONF-8611101—, pp 18, Paper 7) **Color-shaded images from microfilm.** Gong, E. (Lawrence Livermore National Lab., CA). 1986. NTIS, PC A11/MF A01. Order Number DE88000230/JAW.

From 14. annual conference of the Department of Energy/ Contractors Micrographics and Information Management Association; Pleasanton, CA, USA (4 Nov 1986).

Copies of slides present information in the following areas. I. Color-shaded Images from Black and White Microfilm: (a) ability to do solid modeling and generate 3-d color images; and (b) color separation process. II. Engineering Informational Drawings: (a) single image consisting of shaded picture together with line drawing; and (b) merging shaded image with line drawing. III. Hardware: (a) image graphics, electron beam recorder; and (b) host computer. IV. Software: half-tone approximation. Results showed that high-quality black and white prints composed of image with a line drawing and high quality color-shaded images are possible.

10652 (CONF-8611101—, pp 12, Paper 8) **Nuclear Services Records Management System at General Electric Company Nuclear Energy Business Operations.** McCarthy, F. (General Electric Co., San Jose, CA). 1986. NTIS, PC A11/MF A01. Order Number DE88000230/JAW.

From 14. annual conference of the Department of Energy/ Contractors Micrographics and Information Management Association; Pleasanton, CA, USA (4 Nov 1986).

Copies of 12 slides indicate the activities of GE-NEBO with listings under each slide. The slides are: NEBO Locations; Nuclear Locations; Nuclear Products; Data Management; Graphic Scanning and Drawing Conversion; Storage and Retrieval System; Storage and Retrieval System Functionality; Storage and Retrieval System; Storage and Retrieval System Components; and Computer-Based Systems.

10653 (CONF-8611101—, pp 9, Paper 9) **Electronic print room.** Mitschkowetz, N. (Lawrence Livermore National Lab., CA). 1986. NTIS, PC A11/MF A01. Order Number DE88000230/JAW.

From 14. annual conference of the Department of Energy/ Contractors Micrographics and Information Management Association; Pleasanton, CA, USA (4 Nov 1986).

Copies of 8 slides are presented, the first three noting the moving of ideas, plans, and concepts toward an engineering system. The 4th slide, the record, captures and concept and eventually transports the information human to human, human to machine, machine to human, and finally, machine to machine. Slide 5, the Implementation consists of reading the record, transforming the image and instructions, and producing the hardware. Slide 6 Engineering Records Management, defines and describes the functions of engineering records management. Slide 7, LLNL Engineering Management, presents the charter, requirements, and implementation. Slide 8, Electronic Record Management Issues consists of the retention schedule, environment; classification, and accountability.

10654 (NIIAR—3(684)) **RIAR automated research and management systems.** Ivanov, V.B.; Kachalin, V.A. (Nauchno-Issledovatel'skij Inst. Atomnykh Reaktorov, Dimitrovgrad (USSR)). 1986. 27p. (In Russian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88700934/JAW.

General principles of designing, status and prospects for the automated research and management systems at the Research Institute of Atomic Reactors are presented. Urgency of complex investigations carried out in the institute assuring acquisition, processing and holding of the data to prove key concepts of design approaches to newly built commercial NPPs is stressed. Description of automated research systems in three main scientific directions: in reactor materials technology, radiochemistry and chemical technology, nuclear reactor physics and technology, is presented. Status and prospects for the automated management system that is under the development in the Institute and comprises main functional and specialized subsystems are considered. 9 refs.; 7 figs.

10655 (UCRL—97693) **Speculations on the special library of 2010.** Fisher, H.L. (Lawrence Livermore National Lab., CA (USA); Golden Gate Univ., San Francisco, CA (USA). School of Telecommunications Management). Nov 1987. Contract W-7405-ENG-48. 10p. (CONF-8711111—1). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88003297/JAW.

From Information profession - facing future challenges; Washington, DC, USA (4 Nov 1987).

This presentation examines some of the major technological, cultural, and sociological trends and changes driving us toward the world of 2010, thus providing a framework for understanding the information needs of the organization of the future and the nature of the special library that will respond to these needs.

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10856 **(IAEA-INFCIRC—167(Add.13)) Text of the third agreement to extend the regional co-operative agreement for research, development and training related to nuclear science and technology of 1972.** (International Atomic Energy Agency, Vienna (Austria)). Sep 1987. 8p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88700858/JAW.

The full text of the third agreement to extend the regional co-operative agreement for research, development and training related to nuclear science and technology of 1972 (INFCIRC/167) (extended first in 1977 and then in 1982) for a further period of five years with effect from 12 June 1987, is reproduced.

10857 **(SAAS—353) Content and implementation of new legislation governing atomic safety and radiation protection in the GDR.** Iffiaender, G. (Staatliches Amt fuer Atomsicherheit und Strahlenschutz, Berlin (German Democratic Republic)). 1987. 21p. (In German). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88700942/JAW.

In the regulatory framework of the GDR all measures aiming to ensure the safe use of atomic energy are defined by the term Atomic Safety and Radiation Protection, where atomic safety includes nuclear safety, physical protection and nuclear material control. In 1984, a new Atomic Energy Act went into effect followed, in 1985, by the new Ordinance on the Assurance of Atomic Safety and Radiation Protection and the pertaining Executory Provision. Section 2 of the Ordinance defines the following goals for the safe use of atomic energy: (1) the protection of life and health of man, and, from the genetic point of view, also of future generations from the harmful effects of ionizing radiation; (2) the protection of the environment from radioactive contamination, in particular by the careful handling of radioactive materials and safe disposal of radioactive wastes; (3) the protection of workers in nuclear facilities and of members of the public in their surroundings, and of material assets by strict observance and implementation of nuclear safety and radiation protection measures; (4) the protection of nuclear material and nuclear facilities from any criminal attacks and unauthorized interference; and (5) the fulfilment of the Safeguards Agreement concluded between the Government of the GDR and the IAEA by accounting for the use of nuclear material exclusively for peaceful purposes. Under Section 6 of the Atomic Energy Act, the National Board for Atomic Safety and Radiation Protection (SAAS) is the competent authority for the state control in the field of protection against the risks from the use of atomic energy, which is exercised by licensing and surveillance as described in this report. Other topics also dealt with in more detail are the in-plant organization of atomic safety and radiation protection and the powers of the regulatory body to impose enforcement measures and sanctions in the event of non-compliance with the pertinent provisions.